HE READING

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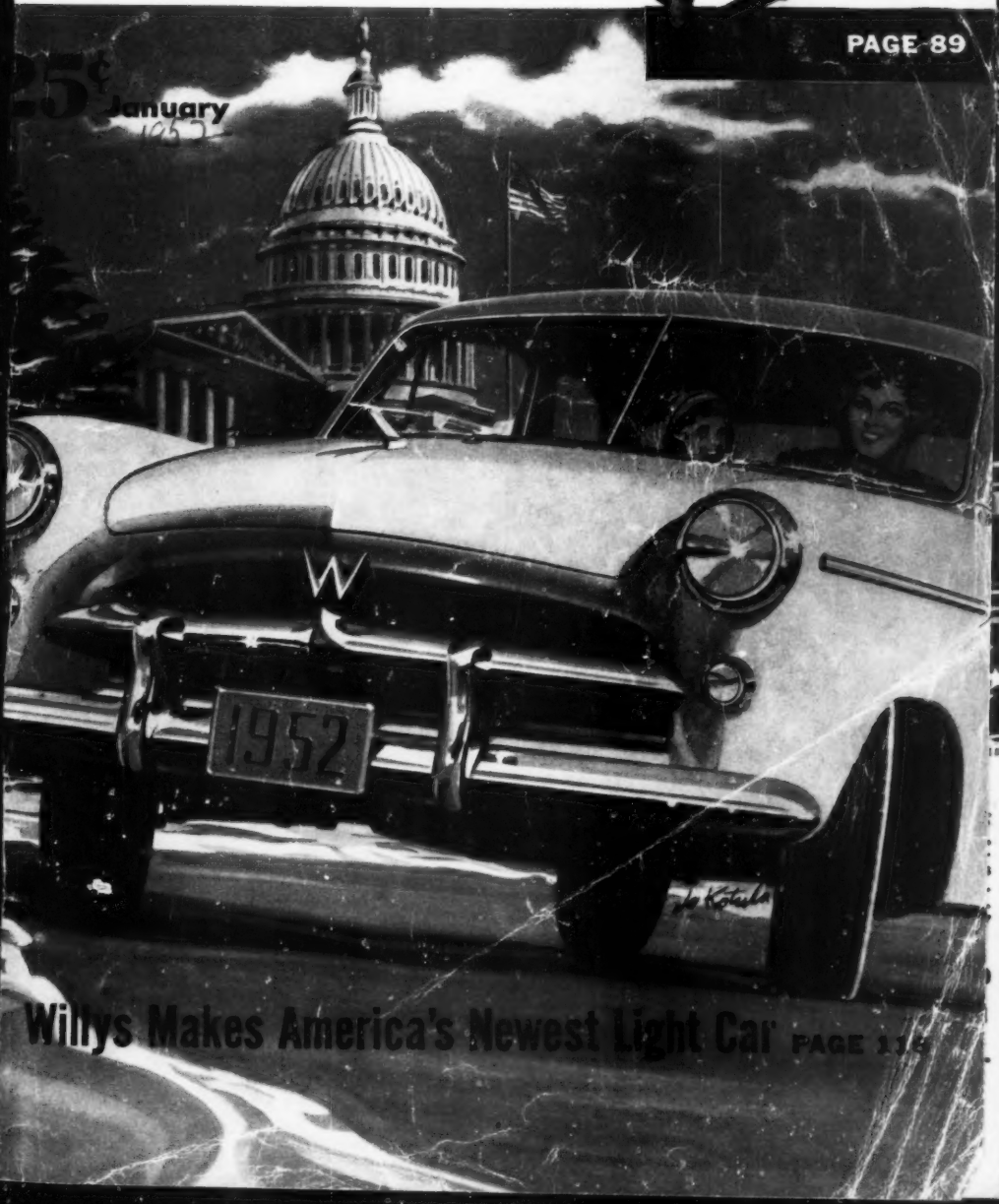
MONTHLY

ECHANICS AND HANDICRAFT

Midget Helicopter

PAGE 89

25¢ January 1952



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Mechanics and Handicraft

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This Month's Big Features:

Death Designed This Fire Truck 81
Men Will "Wear" This Helicopter 89
How a One-Armed Bandit Works 91
Trouble Is Their Pastime 96
'52 Pontiac Has New Power Train 101
Railroading at 72° Below 110
America's New Light Car 116
Jackpots in Suggestion Boxes 125
How a Champ Drives a Truck 156
Electric Trains Are Fun All Year 161
Tune Your TV Set from Across the Room 167
How an Expert Soups a Stock V-8 172
Gus and the Car That Wouldn't Turn Left 178
Hamper Dries the Clothes, Too 183
Get Acquainted with Files 186
His Camera Earns Over $500 a Day 192
How to Use Patterns with Power Tools 196
How Compressed Air Can Help You 212

Willy Ley is an outstanding authority on rockets, and author of such popular books as The Conquest of Space *and* Rockets, Missiles, and Space Travel. *On page 137 he projects Jules Verne's famous globe-girdling tale 80 years into the future.*

(More features and departments are listed on page 4.)

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Tech

Piston ring progress

1945

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Picture Features

Atom Pile to Run on Uranium Pill..... 86
"High-Hat" Hot Rods..... 94
How Niagara Falls Will Work Nights....103
Baby Gas Turbine Runs Pump.....123
Precast Walls Go Up in a Day.....128
How Asphalt Tile Is Made.....132
4-Deck Parking Lot Uses Drawbridges..134
Scientist Invents Color-TV Tube.....145
Loggers Invade African Jungle.....150
Why Supersonic Planes Go Boom.....154

Mechanics & Handicraft

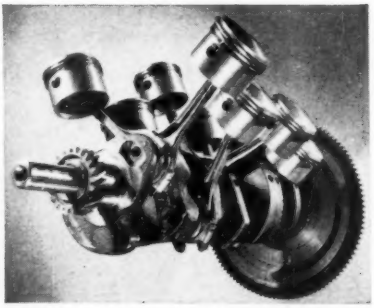
Where's the Car Key?.....177
Get More Out of Basement Shelves.....190
Sparks from Your Fingers.....202
Sawing Tapers to the Line.....209
Homemade Sandblaster.....215
Milling in Your Drill Press.....218
How to Round Corners.....222

Departments

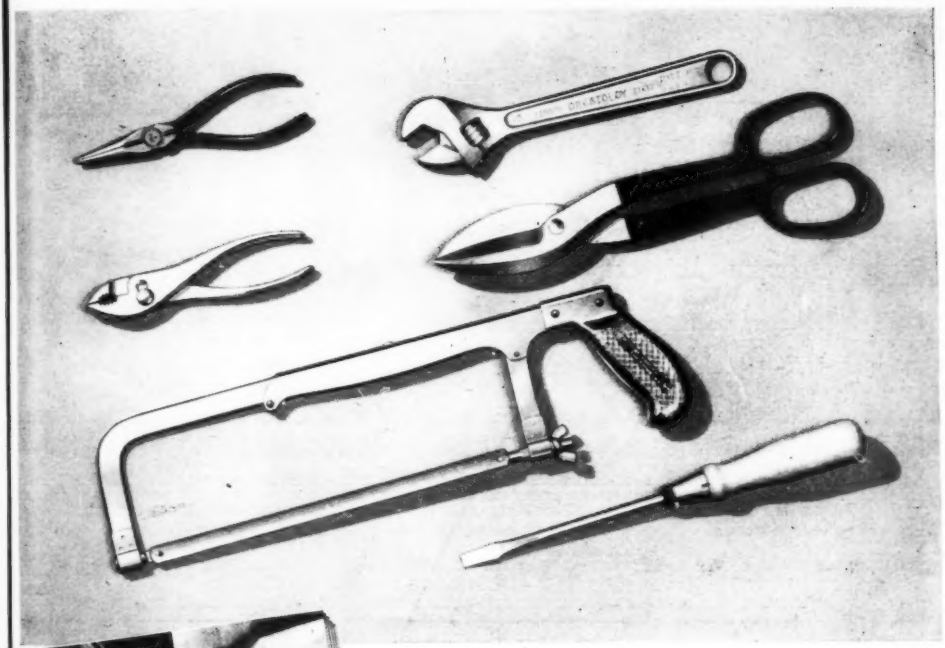
Letters 14
New Ideas from the Inventors.....113
Keeping the Home Shipshape.....121
Aids to Modern Living.....142
I'd Like to See Them Make.....148
P.S. Last Minute News and Notes.....160
Hints from the Model Garage.....181
New Tools.....210
New Shop Ideas.....216

NEXT MONTH:

Balancing for Power



Finely crafted parts like these move at high speed to pour out the power from your auto engine. If they are only slightly out of balance, vibration and greatly increased bearing loads soak up power, wear out the engine before its time. Next month, PS tells you about an expert, one of a handful in the U. S., who rebalances stock engines until they are as smooth as cream—and more powerful than before.



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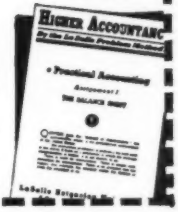

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New, special TV kits furnished to build high-definition SCOPE . . . RF OSCILLATOR with flyback power supply . . . complete TV SET . . . many other units. You see pulse, trapezoidal, saw-tooth wave forms. Get valuable PRACTICAL EXPERIENCE locating and correcting TV troubles. Mail coupon for facts, pictures and prices!

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"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. Am now Chief Engineer Police Radio Station WQOX."T. S. Norton, Hamilton, Ohio.

I TRAINED THESE MEN

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In 1946 only 6,000 TV sets sold. In 1949 almost 3,000,000. By 1954, 20,000,000 TV sets will be in use, according to estimates. 100 TV Stations are operating in 35 states. Authorities predict there will be 1,000 TV Stations. This means new jobs, more jobs, good pay for qualified men.

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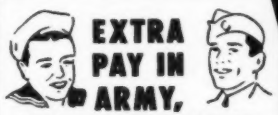
Let me show you how to have a good, steady income from your own Radio-Television shop. Many N.R.I.-trained men each year start without capital, like Robert Dohmen, New Prague, Minn., above. He writes, "Am now tied in with two television outfits."



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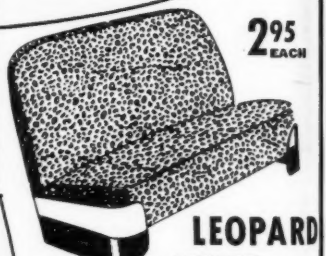

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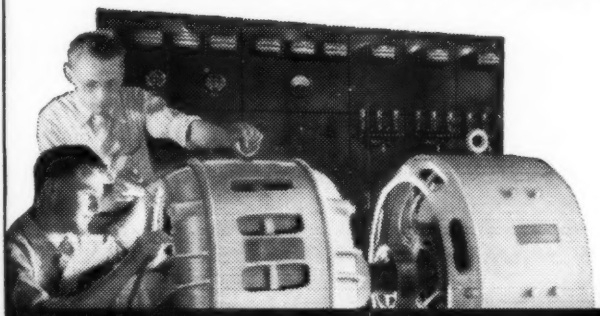

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(Right—Instructor helping students check the wiring and trace circuits of television receivers.)

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Letters

Atomic Air Train?

I read your article on atomic-powered aircraft [Oct. '51, p. 98] with interest.

You point out that the heavy power plant and entrained apparatus will about offset the advantage gained by fuel-tank elimination. But if the craft has unlimited range and unlimited *power,* at low amortized costs, then the answer would appear to be very simple: namely, just install the atomic power plant in a towplane, which need be only large enough to house it, and then use the towplane to haul a glider train.

OWEN BROWN, Los Angeles

Duller Cars, Not Drivers

In your story on one of the new cars Wilbur Shaw says: "I got an excess amount of reflection from the surface of the shelf behind the windshield. It had an enamel-like black finish. Automobile manufacturers ought to dull-finish all such surfaces in the interest of safer driving."

AMEN!

FRED A. COVEY, Berkeley, Calif.

The Wild, Tiled Wilderness

Senator Richard L. Neuberger, in your November issue ["Engineers Invade Another Wilderness," p. 98], has written the finest, most factual and comprehensive article I have ever read in an American publication concerning Canada, and particularly British Columbia's industrial progress in the last 10 years.

It's not all bear, moose and water power that we have up here. That's why we appreciate his reference to tile swimming pools.

ROSS S. THOMPSON, Vancouver, B. C.

Warm Welcome

I'd like to compliment you highly for the excellent treatment you gave the article on "How a Thermostat Tends Your Furnace" [Nov. '51, p. 148].

It is, to my knowledge, the first time anyone has translated the operation of a thermostat into such easily understood terms.

JOHN F. BUDD, JR., New York City

Norwegians Got Nuthin on Us

The October issue [page 103] has a picture of two Norwegian students riding in a Model T Ford with the tires filled with straw.

Well, sir, to some of us fellows the idea is not very new. In 1929, I had a Buick touring car, and seven of us were on our way back to Chicago after spending a week end at a lake.

Our tires were good, but the tubes were bad, and we had two flats. The tubes were beyond patching, and we had no spare. We could not buy any tubes that size, so we stuffed the tires with grass. We rode about 20 miles and had to stuff in more grass because it was drying out. After the second stuffing, we got home okay and rode around on those tires for two weeks until we replaced the grass with new tubes.

WM. HODOVAL, Chicago

Warning on Burning Batteries

May I add a precaution to your suggestion that old flashlight cells be burned in a fireplace to prevent formation of soot [Nov. p. 151].

Some flashlight cells are made with a complete metal covering. If this sealed type is put in the fire, gas pressure builds up until they pop. I had this happen in my furnace. In a fireplace, it could scatter ashes or burning embers around the room. Better put this type in the ash can.

BOB GLAESER, Cleveland

Our item should have specified batteries of the non-sealed type.

How to Clean a Carb

In your November 1951 issue, page 190, there appears the statement: "These [var-

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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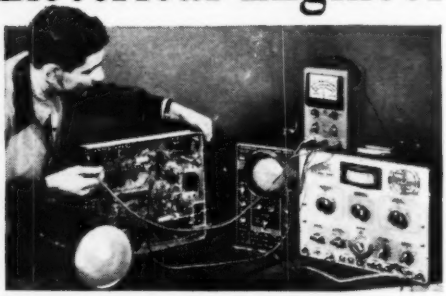

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nish-like] deposits should be washed off [the automatic-choke linkage] every 5,000 miles with lacquer thinner. Most other solvents won't work."

Tests by independent laboratories and carburetor manufacturers have proven that Gumout, made by Pennsylvania Refining Company, Cleveland, completely removes, by chemical action, all gum, sludge, muck and other foreign matter that accumulate in carburetors.

HAROLD B. MONTGOMERY, Philadelphia

He Did It His Way

The tcetihcra (a backwards architect) who designed the "'Merry-Go-Round' to Park Cars" on page 164 of the October issue must have been sitting out in a snowstorm on a hot summer day watching a tail wag his dog when he thought up such an absurd idea.

Instead of rotating six floors with tons of parked automobiles on them, why doesn't he rotate the elevator with one to four cars on it?

HARLIN G. LOOMER, Philadelphia

Distant Dashboards Greener?

In his November article on the Minx [p. 124], Wilbur Shaw says: "Here are those battery and oil-pressure lights that we ought to see on more U. S. cars. . . A green light flashes if the oil pressure is low, a red light if the battery is on discharge."

A lot of British drivers don't agree. In fact they envy us for universally having ammeters and oil-pressure gauges on the dash. Recently the magazine *Motor*, which is practically a Bible for English autoists, complained about the "cheese-paring" of manufacturers who leave off these gauges to save money. They editorialized that the "warning lights as at present fitted to many British cars are by themselves neither trustworthy nor particularly desirable."

Sounds to me like one of those cases where the unfamiliar seems better, mostly because it is unfamiliar.

JACK BENNETT, Boston

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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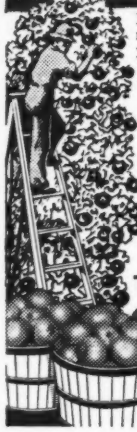

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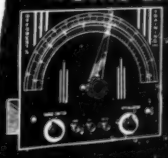

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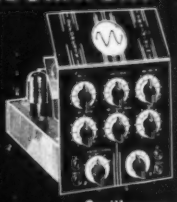

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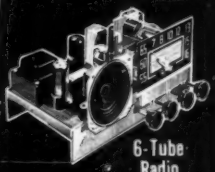

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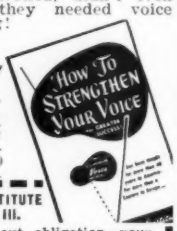

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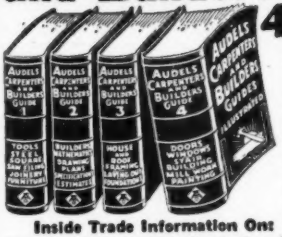

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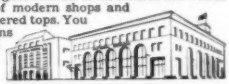

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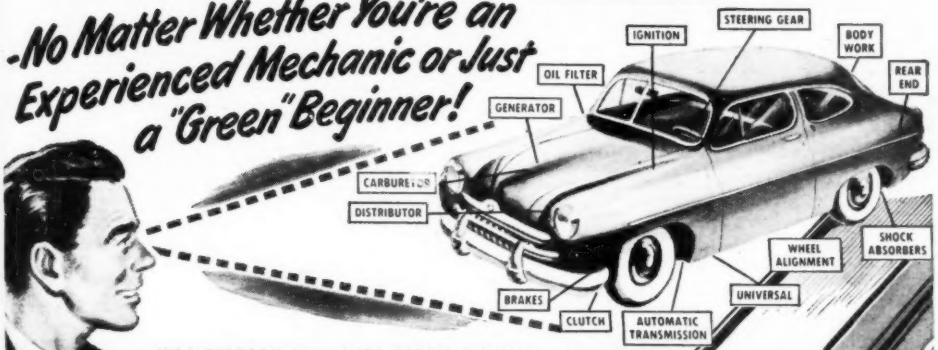

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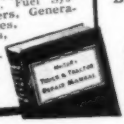

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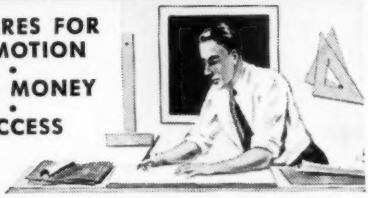

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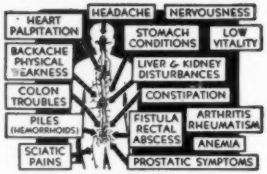

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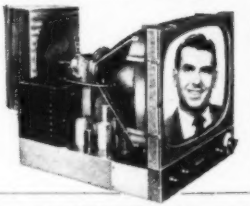

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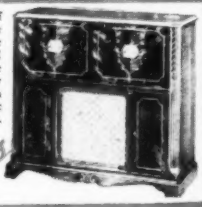

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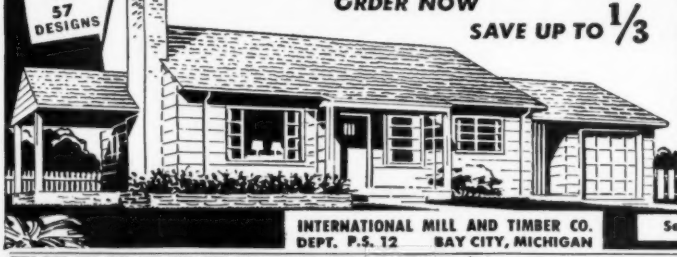

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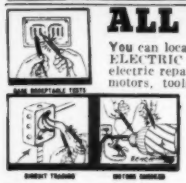

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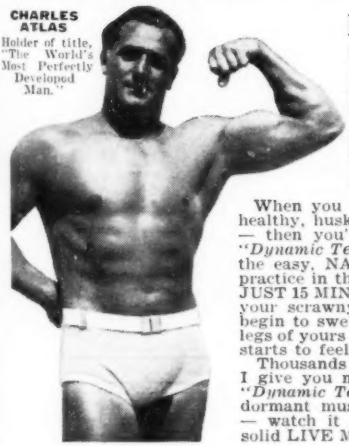

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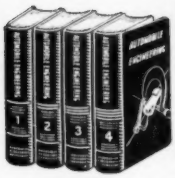

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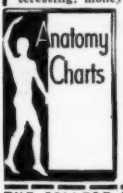

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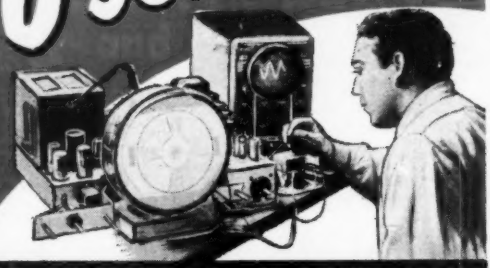

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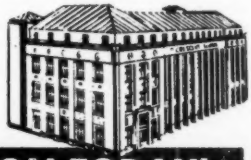

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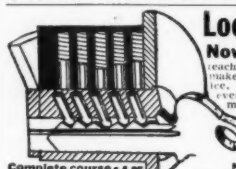

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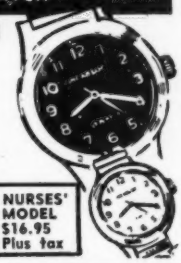

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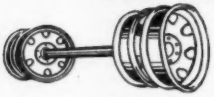

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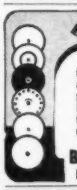

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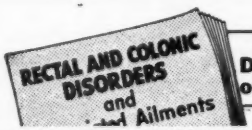

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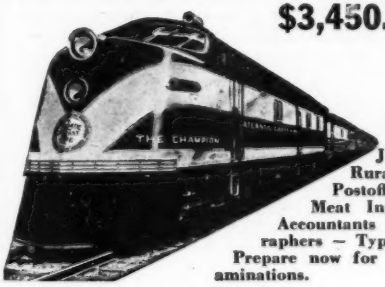

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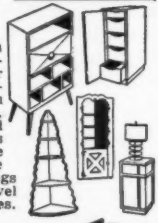

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650-16	6.42	670-15	6.24	650-20	9.94	1000-20	18.54
700-16	7.94	700-15	6.54	700-20	11.94	1100-20	18.54
750-16	7.94	710-15	6.34	32x6(8)	10.54	1000-22	17.54
550-17	5.94	760-15	6.54	32x6(10)	13.92	1100-22	18.54
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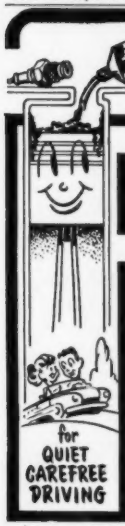

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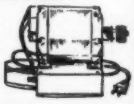

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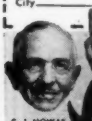

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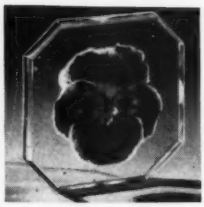

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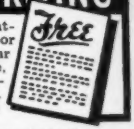

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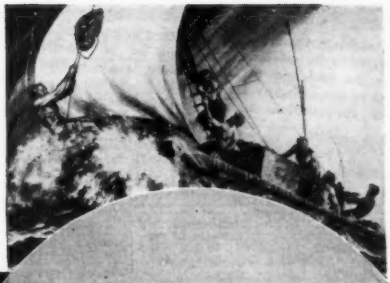

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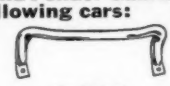

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31 HOBBIES, COLLECTIONS

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42 HELP WANTED

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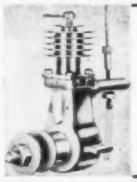

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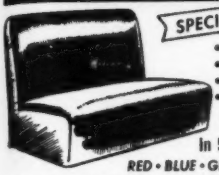

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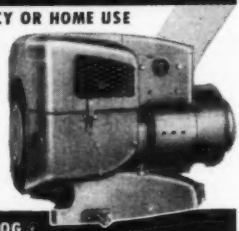

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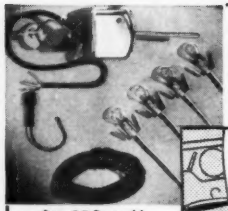

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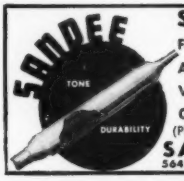

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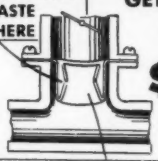

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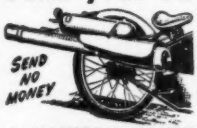

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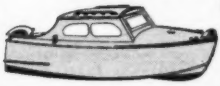

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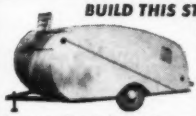

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Pyroil and WINTER OIL

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Pyroil and winter oil GO better together—you'll GO better, longer, at less maintenance cost, with Pyroil.

When you add winter oil—add Pyroil—add miles to your car.

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Use Aircraft Pyroil B for lubricating oil, Aircraft Pyroil A for gasoline.

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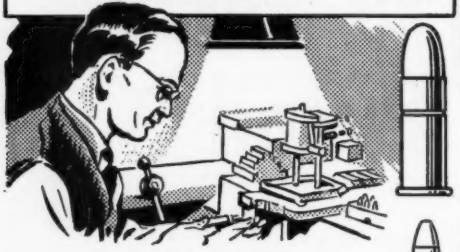

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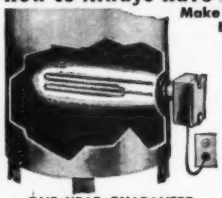

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Faithfully yours 50 *for Fifty Years*

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— AND THERE'S MORE TOBACCO IN EVERY TIN!

Prince Albert's patented* "no-bite" process means real smoking comfort

. . . Prince Albert is made to give you more smoking enjoyment than any other tobacco! P.A. is specially treated to insure against tongue bite. Rich-tasting and mild . . . No wonder it's the big favorite with roll-your-own smokers and pipe smokers alike!

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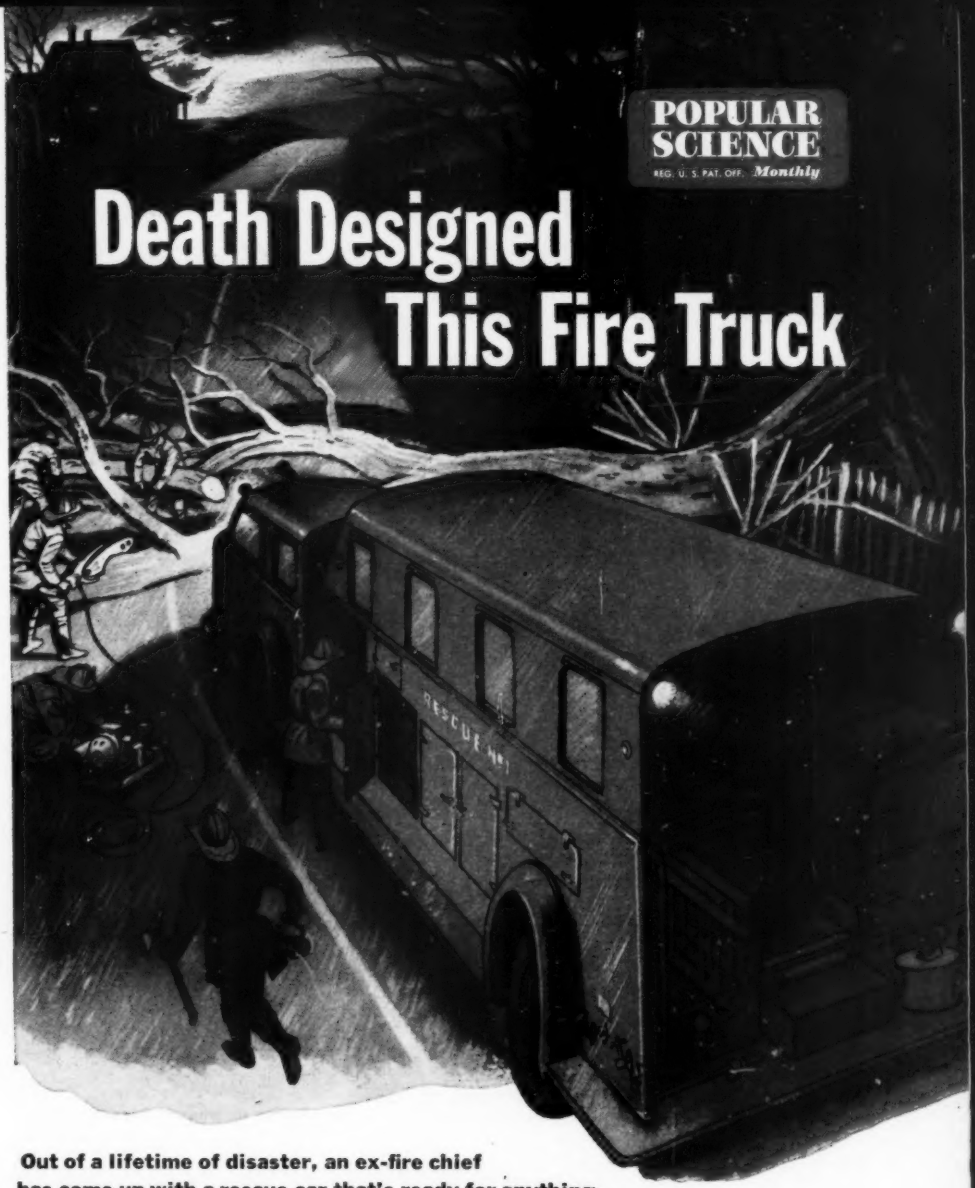
Death Designed This Fire Truck



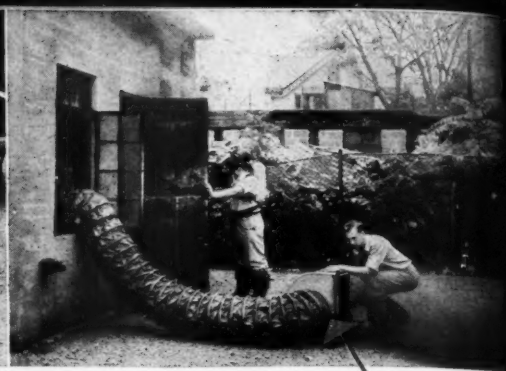
Out of a lifetime of disaster, an ex-fire chief has come up with a rescue car that's ready for anything.

By Gardner Soule

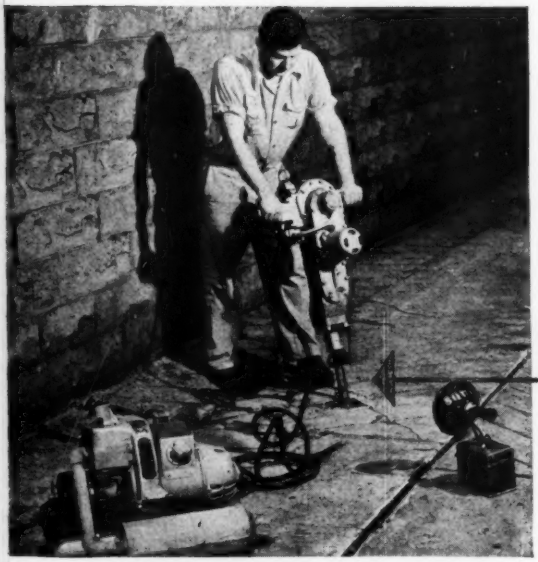
FORTY-TWO years of watching people die and property turn to ashes taught Charles A. McGinley that a really good fire department is one that is prepared for *every* kind of trouble. As a fireman and, for 22 years, as chief of the fire department of East Orange, N. J., he learned a great deal about how to cheat both death and destruction. What he learned has been built into an emergency truck, called Rescue No. 1, that's a trouble-shooting masterpiece. It's ready for anything, from explosions to heart attacks. Custom-built for East Orange, there's literally nothing like it in the world.

McGinley, now 66 and retired, no longer is on call when disaster occurs. Rescue No. 1, built from plans he helped prepare be-

ADMINISTERING OXYGEN is most frequent emergency job for crew of Rescue No. 1. Truck carries several inhalators, a large oxygen supply, foam-rubber mattress, blankets.



SMOKE-EATING CATERPILLAR, a new device called an ejector, clears air in seconds so firemen can enter a burning building. It is an exhaust fan on a bellows-like tube.



PAVEMENT BREAKER, or air hammer, lets rescuers punch through reinforced-concrete floors in commercial buildings to ventilate basements. Portable generator runs it.

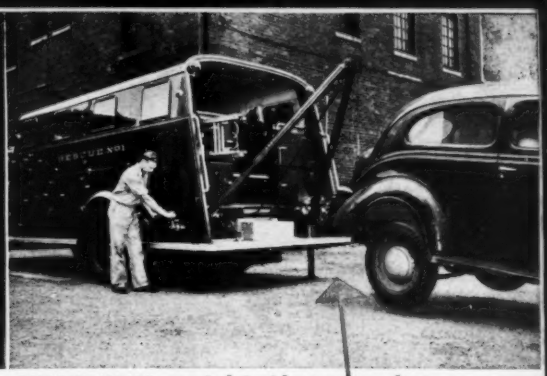
PS PHOTOS BY HUBERT LUCKETT

fore he left the force, not only answered every fire alarm in East Orange during 1951, the first full year it was in operation, but responded to hundreds of emergency calls of other kinds. It has three captains and three crews (five men each), because it is on duty 24 hours a day. It has become a monument to McGinley's planning.

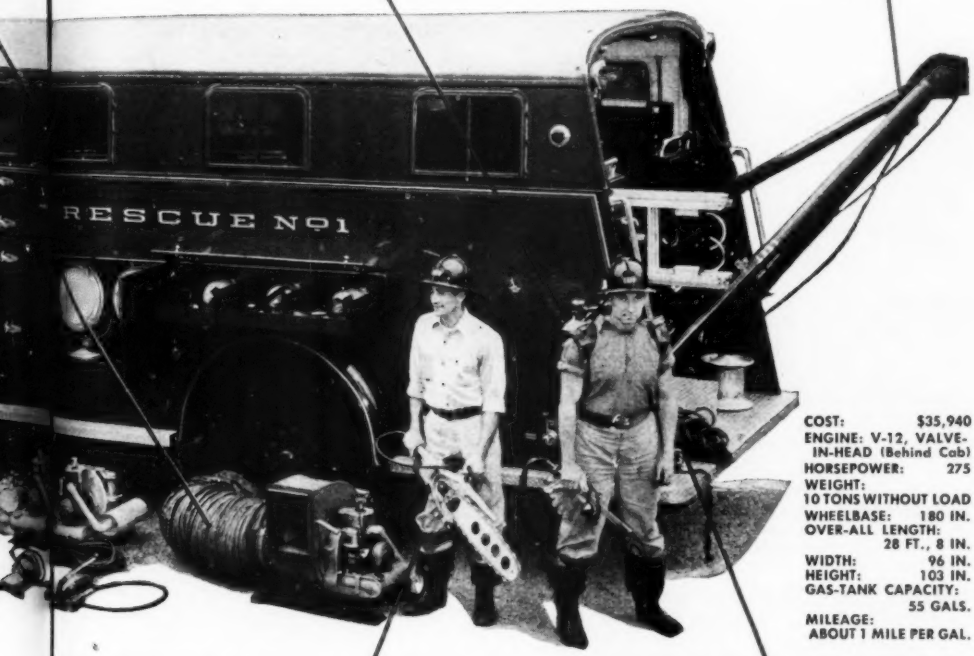
Throughout his career, which began in the days when fire horses used to wake him up at five o'clock in the morning by pounding on their stalls for breakfast, McGinley was always trying to find better ways to fight fires and help people in trouble. It's no wonder that Rescue No. 1, the product of this experience, is called out as often as nine times a day by East Orange citizens.

Ten years ago McGinley arrived at an apartment-house fire to find 51 gas inlets ablaze. The meters had melted off. The gas pressure was terrific and there was no time to put out 51 fires and plug each gas line even if the plugs would hold under the high pressure. "Besides," McGinley recalls, "you couldn't get near 'em." He had provided a special gas-shutoff wrench, never used before, for such an occasion. With it, one of his men stopped the gas as

OXYACETYLENE TORCH is used to free people caught between elevators and shafts and to cut steel girders. Danger of igniting gasoline bars its use in auto-wreck rescues.



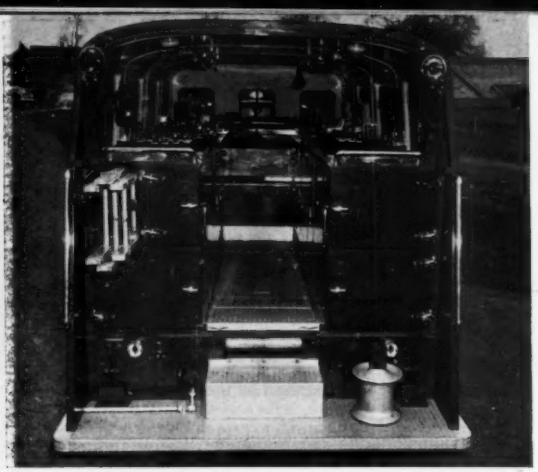
RUGGED HOIST, carried inside truck and set up at emergency scene, lifts weights off people pinned under them. Heavy jacks let down from truck's rear end take the load.



COST: $35,940
ENGINE: V-12, VALVE-IN-HEAD (Behind Cab)
HORSEPOWER: 275
WEIGHT: 10 TONS WITHOUT LOAD
WHEELBASE: 180 IN.
OVER-ALL LENGTH: 28 FT., 8 IN.
WIDTH: 96 IN.
HEIGHT: 103 IN.
GAS-TANK CAPACITY: 55 GALS.
MILEAGE: ABOUT 1 MILE PER GAL.

CHAINSAW helps clear streets and free cars of fallen branches, trees, poles. Truck carries several generators, one of which provides either AC or DC for power tools.

MAN ENTERING SEWER wears a Scott Air-Pack, enabling him to breathe anywhere. Sidewalk tank supplies clean air. Rope, attached to his body harness, can be used to haul him out.

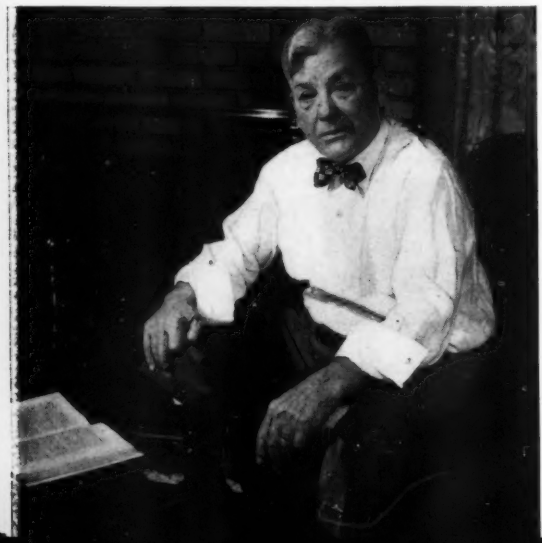


INSIDE RESCUE NO. 1, it's as trim as a bank vault. Ladders, drugs (to be used only at a doctor's call), stretchers, gas masks and radio are here. Two crew members ride with them.

it left the street main. Today the wrench is instantly available aboard Rescue No. 1.

In 1938 the Northeast was hit by a hurricane that was one of the roughest storms in history. In East Orange hundreds of trees were down. "All of us," McGinley says, "had to get out and use handsaws to cut them up. This took a week. We probably could have done it in a day and a half with power saws." Today Rescue No. 1 carries chainsaws, circular saws and power hacksaws. When a recent local windstorm blocked streets and tossed trees onto parked cars, the truck and its crew cleared things up in six hours. Power saws sliced through some big trees in a mere 15 minutes' time.

EX-CHIEF McGINLEY can now enjoy his fireside, content in the knowledge that all he learned about fighting disasters is being applied every time that Rescue No. 1 answers a call.



Five years ago McGinley and his men fought a fire in the basement of a garage. Thousands of tires were burning. The entrance, a ramp, was blocked by heat and smoke. No fireman could enter. With compressed-air hammers, the men made a sieve of the concrete floor above the garage basement and poured water through the holes. That quenched the fire before it could spread.

"That was proof to me," McGinley says, "that every fire department needs an air hammer. If you only use it once in a lifetime, it saves your skin." Rescue No. 1 has an air hammer.

Firemen Are First Aiders, Too

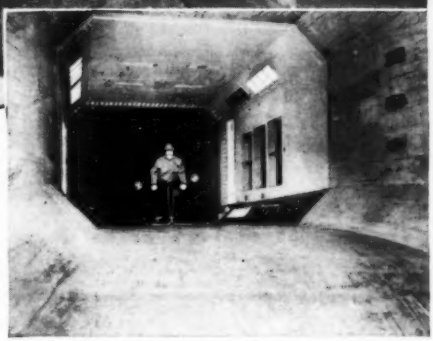
Over the years McGinley saw people die —from heart attacks, gas asphyxiation, electric shock—for lack of oxygen. "Too few fire departments have enough oxygen at hand," he says. "We keep a 24-hour supply." Rescue No. 1 carries a dozen bottles of this lifesaver. More is in the basement at headquarters. If No. 1 runs out, the chief's car races back to headquarters for replacements. In 1951, East Orange's new emergency truck answered more than 200 calls when oxygen was needed.

McGinley once saw a man screaming with pain from a mangled and broken knee after his car had hit another head on. An untrained bystander tried to move the man and in doing so hurt him far worse and made his injury more serious. McGinley resolved then that his rescue squad would be experts. "Today," he says, "they all have first-aid certificates from the Red Cross." Rescue No. 1 carries a supply of bandages, splints, tourniquets, blankets, stretchers and a mattress. The men drill continually in the use of this equipment.

Stuck Elevators Are a Specialty

There weren't many elevators when McGinley started as a fireman. As buildings grew, the number of elevators increased, and so did the number of cases of people getting stuck in them. Today East Orange's rescue-squad men are among the few in the country who can move an elevator by hand, from the top of the shaft, and bring it in front of a door. If someone is trapped between the elevator and the shaft wall, they have cutting tools, including an oxy-acetylene torch, to get him out.

[*Continued on page 270*]

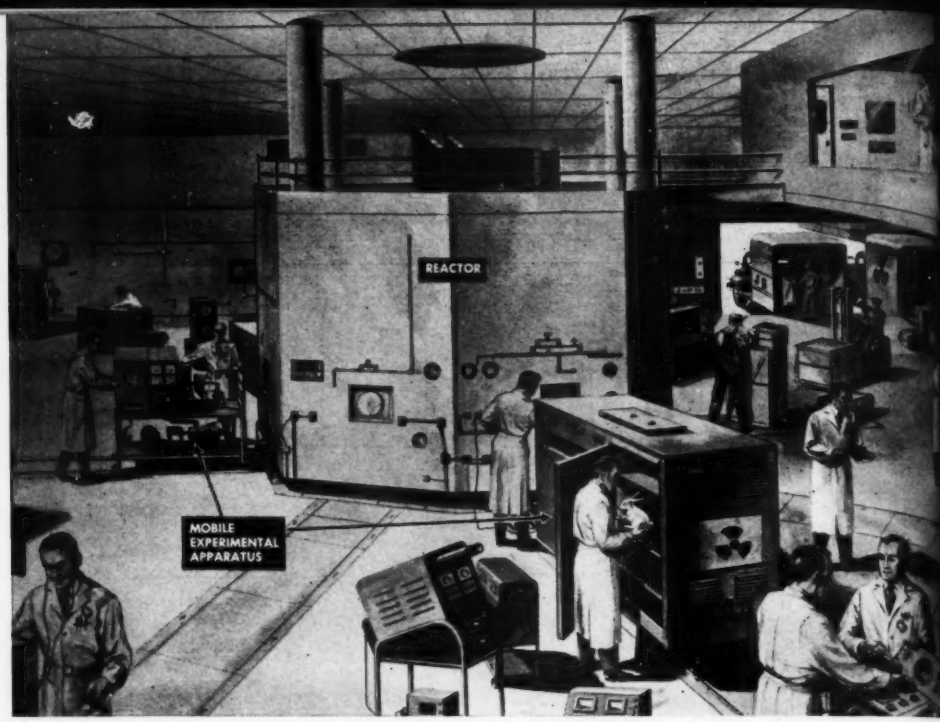


Skiers Train in Wind Tunnel

WITH plenty of breeze but no snow at all, these crack British skiers are practicing inside a Royal Air Force wind tunnel. The champion skiers, who will go to Oslo next month to represent Great Britain in the 1952 Winter Olympics, are also helping the RAF study the relation between body angle and wind resistance.

Attack Bomber Is 12 Planes in One

THE latest Douglas Skyraider, primarily a carrier-based bomber, can rapidly be made over into any one of 11 other types of plane. Packaged conversion kits come with its "universal chassis," enabling it quickly to become a flying ambulance, a photo plane, an anti-submarine hunter-killer, a passenger transport or whatever is needed.



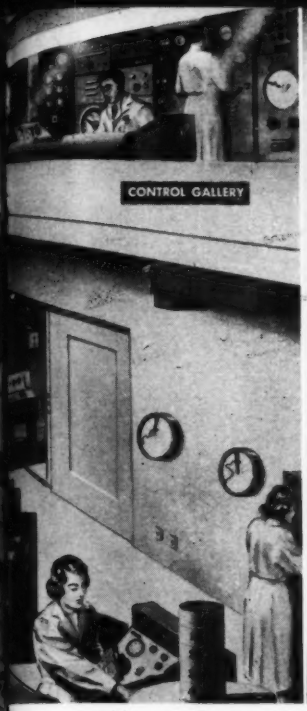
How baby pile might be set up in college or industrial laboratory is sketched above. Operator

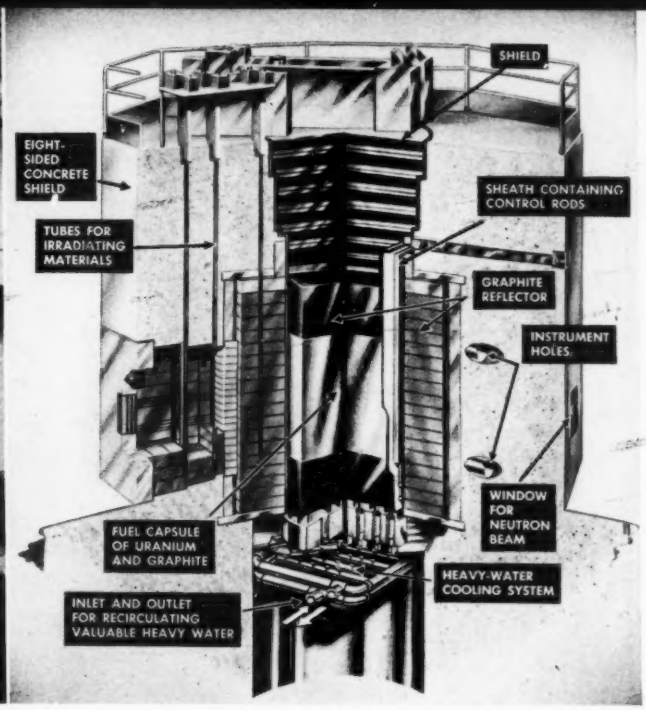
Baby Atom Pile to Run 10 Years on Uranium Pill

PARTS for the first "popular-model" atomic furnace, a 160-kilowatt midget called the Low Power Research Reactor, are already being tested. Like Government piles 100 times its size, it will permit atomic experiments and manufacture valuable radioactive isotopes—including those too short-lived to be shipped from afar. It is the smallest ever designed for such prac-

Helicopter Hitches Ride to a 'Rescue'

AERIAL hitch-hiking can greatly increase the range of rescue helicopters, experiments at Wright-Patterson Air Force Base reveal. Sikorsky S-51s and H-5s have been successfully towed by C-47s, C-54s and C-82s. The helicopter hovers in the air, with slack towrope, as the plane takes off. Once stabilized in flight, the 'copter pilot cuts his engine, but retains use of his controls at all times.





would run it from control gallery overlooking main floor. Cutaway shows details of design.

tical uses—a concrete octagon only 19 feet in diameter and 11 feet high. The design is not secret.

A fuel capsule of enriched uranium and graphite, sealed in an aluminum can, will run the pile 10 years and can then be replaced. This obviates elaborate machinery to feed in uranium "slugs." A novel cooling system uses "heavy" water, which absorbs fewer neutrons than ordinary water does. Automatic built-in safety features make the pile the first of its power suitable for use in the heart of a city.

Worked out for the Atomic Energy Commission by North American Aviation, Inc., the design will be made available to college and industrial laboratories. Building one is expected to cost $1,000,000.

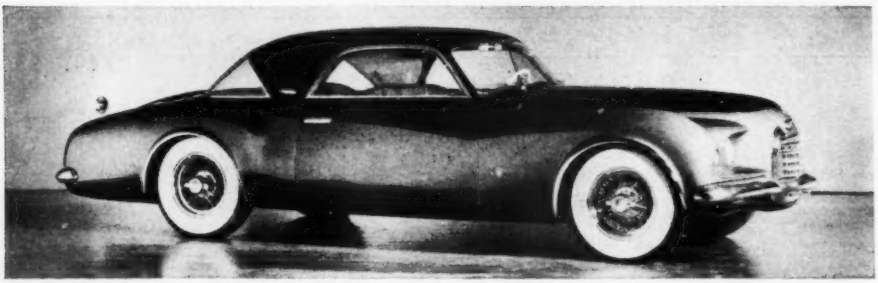
Inflatable Top Covers German Cycle-Car

When it rains, you put up the top of this tiny German convertible by unfolding a small piece of plastic, blowing it up and buttoning it on. Deflated and folded, the top is small enough to tuck neatly into a handbag.

The vehicle is a three-wheeled car that appears to be a cross between a motorcycle and an automobile. It has a 100-cubic-centimeter, 4.5-horsepower engine.

Spray Truck Bathes New York Tunnel

When New York City's Brooklyn-Battery Tunnel needs a cleaning, which is twice a month, the special tank truck shown in the photograph at the right goes to work. It sprays the white tile walls and ceilings, coated with the exhaust fumes of thousands of automobiles, until they sparkle again. The job of sprucing up the world's second-longest vehicular tunnel takes two nights to finish. It uses up 60,000 gallons of water and 7,000 gallons of cleaning solution, enough to fill several standard railroad tank cars, to wash the area of 780,000 square feet. This tunnel, New York's newest, runs under the East River from the tip of Manhattan Island to Brooklyn.



310-Hp. "Dream" Chrysler Has U.S.-Designed, Italian-Built Body

A "dream car" of 310 horsepower, with four carburetors and an 8:1 compression ratio, was announced last month by the Chrysler Corp. It was the third in a series of experimental automobiles made public in Detroit as laboratories-on-wheels.

Chrysler's car was styled in the U. S. by the company's engineers but was built in Turin, Italy, by Carrozzeria Ghia, a prominent Italian body maker.

K. T. Keller, the Chrysler chairman, said the K-310—as the car is called—"sets entirely new objectives to reach for" in passenger-car development.

The K-310 is powered substantially with the same overhead-valve engine announced by Chrysler in March, 1951 (PS, p. 134). Modifications raised its horsepower from 180 to 310. The piston displacement is exactly the same—331 cubic inches. The sole item of information Chrysler has disclosed on what it did to the engine to get this theatrical increase in horsepower is the statement that the valve sizes have been increased—plus, of course, the boost in the compression ratio. The engine burns commercial premium (Ethyl) fuel.

The K-310 has sweeping lines, a low, flat hood and large wire wheels. It has a 125½-inch wheelbase and an over-all length of 220½ inches. Added features include an adjustable steering wheel, an automatic transmission, electric window lifts, power steering and an electric seat-adjusting mechanism. One of the elevated directional and tail lights is seen sticking up on rear fender.

PINWHEEL PILOT would wear flying suit and crash helmet with plastic face shield. Flying into enemy territory he could easily carry a rifle. Cargo hook (not shown) could carry a machine gun, small mortar, ammo for cut-off units, or medical supplies. Walkie-talkie can be detached for use on ground.

Men Will 'Wear' This Helicopter

By Herbert O. Johansen

"WHAT were you in the war, Daddy?" some future son may ask an ex-Marine.

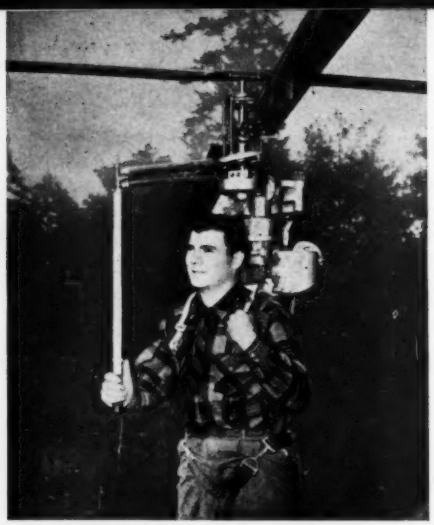
"I was a helicopter," he may reply.

Junior, of course, would know all about Pinwheel, the rocket-powered helicopter rig that's worn like a back pack.

Although such a machine is still in the experimental stage, it has actually been ground-tested for the Office of Naval Research—presumably for use by the Marines.

The inventor of the gadget that converts one man into a bird is a 38-year-old aeronautical engineer, Gilbert Magill, president of Rotor-Craft Corp., Glendale, Calif. In discussing his brain child, he revealed:

- It weighs considerably less than 100 pounds, yet can easily carry a man plus 100



THE HOPPICOPTER, earlier back-pack rig, weighed only about 60 pounds, but its two-cylinder, 20-horsepower engine wasn't able to lift a man more than a few feet.

or so pounds of his equipment in flight.

- It will take off vertically faster than any helicopter and descend vertically for a gentle landing in an area the size of a desk top. It will hover in mid-air and, in case of engine failure, can windmill down for a leisurely emergency landing.
- It is strapped to the pilot's back. He sits on a bicycle-type seat, with perhaps a footrest from which a cargo hook dangles. Mounted on a tubular control stick in front of him are the throttle, a simple instrument panel with perhaps a tachometer and altimeter, and a walkie-talkie.
- When he is ready to take off, a turn of the throttle releases liquid chemicals from twin fuel tanks mounted on his back. When these chemicals meet in the combustion chambers of tiny rocket engines at the tip of each rotor blade, they mix and ignite instantaneously, creating a rocket-jet thrust that spins the rotor at high speed.
- It will be ideal for night operations into enemy territory. Its rocket engines spew no flame and are much quieter than ordinary jets, although they still sound somewhat like a muffled locomotive.

ONE OF SMALLEST HELICOPTERS to fly is Little Henry, a test rig. It weighs 310 pounds, can lift about 300 pounds of load. Unlike the Pinwheel, it uses ramjets to spin its rotor.

Flapping Wings Have Failed

The Pinwheel comes close to satisfying one of man's oldest ambitions—to fly by himself like a bird. The ancient Greeks wove a story around that theme, and Leonardo da Vinci left us a design for a pair of flapping wings powered by human muscles. The flapping wings never worked, however, and man finally resigned himself to sitting inside a machine that would do the flying for him.

Yet he still yearned to make like a bird in "personal" flight. Then the helicopter came along with what seemed to offer a bright light of success. Back in the Thirties, Dr. George de Bothezat designed a one-man, back-pack helicopter, but his death brought the project to a premature end.

Then came Horace T. Pentecost's Hoppicopter in 1945 (PS, July '45, p. 68). Powered by a 20-horsepower, two-cylinder engine, it was strapped to the pilot's back. When a 180-pound Air Force officer tested it, however, he wasn't able to get more than six feet off the ground. Another version, with landing gear (PS, May '48, p. 117), didn't do much better.

Civilian Use Foreseen

Magill is convinced that he has the answer in rocket power. At present he is concentrating on purely military applications, especially for situations where long range and high speed are not a factor. (A guess would be a speed of about 60 miles an hour and a range of about 20 miles.)

He does, however, look ahead to its possible civilian use as a sort of aerial scooter. Greater range and lower cost would first have to be built into rocket fuels. Then, as a civilian probably would not want to don a crash helmet and flying suit to hop across town, the seat could be enclosed in a plastic bubble—perhaps big enough for two. Small casters might be added for landing.

But there we are—getting right back from personal flight to man surrounding himself with a flying machine. END

COINS FROM A NICKEL UP feed the appetites of America's slot machines—illegal in 43 states and robbers in all.

How a One-Armed Bandit Works

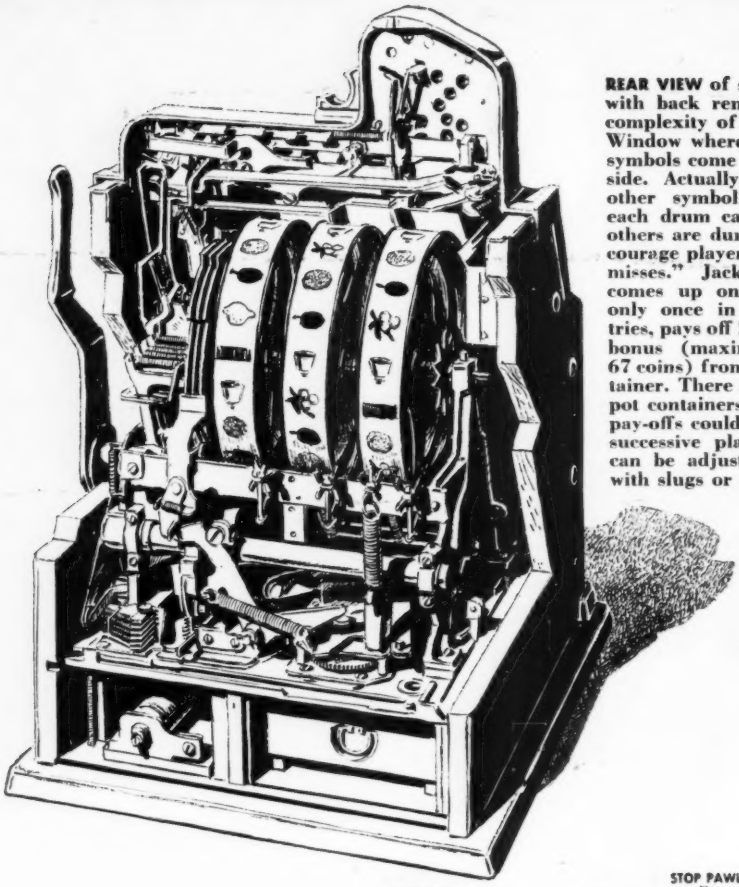
For sheer greed, a mechanical gambler beats them all—even when it's "honest." And most of them are fixed.

By Hartley E. Howe

ANYBODY who gambles steadily with a professional—and a slot machine is very much a professional—is bound to come out a loser in the long run. That's because the pro makes his living by taking something from each bet or play. How much and how quickly a sucker loses depends on this "take." The take of a slot machine would make Canfield himself blush.

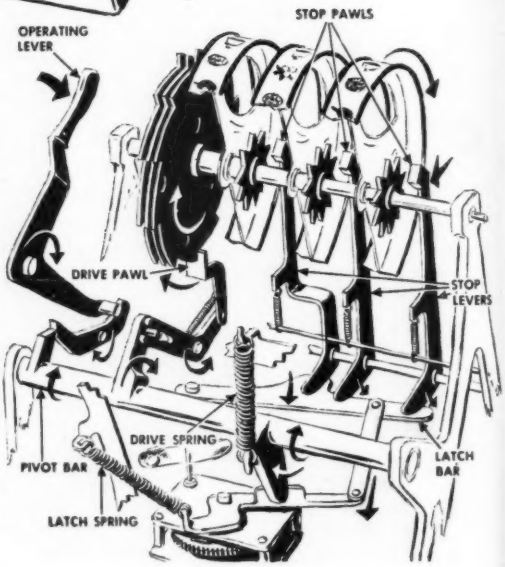
An "honest" machine—one operated with real self-restraint—keeps 25 cents out of every dollar put in. An average machine keeps about 33 cents out of a dollar. But a machine that has been fixed—and it's not hard—keeps anything up to 80 cents out of every dollar played. The only reason it doesn't keep still more is that a machine has to pay off occasionally to keep the customers coming back.

As you probably know, the machines pay off varying amounts when certain symbols line up on three drums that are spun by pulling a lever. The odds that are built into a machine depend on the number of times the pay-off symbols—bells, cherries, bars and so forth—appear on the drums. But the pay-off is always far less than the actual odds against the player. In a 25-percent "take" machine, for example, a combination that pays back 16 to one only shows up once in 500 times, while the common two-to-one pay-off actually has odds of more than



REAR VIEW of slot machine with back removed shows complexity of mechanism. Window where player sees symbols come up is on far side. Actually only every other symbol of 20 on each drum can come up: others are dummies to encourage players with "near misses." Jack pot, which comes up on average of only once in a thousand tries, pays off 20 coins plus bonus (maximum, about 67 coins) from special container. There are two jackpot containers, so that two pay-offs could be made on successive plays. Machine can be adjusted for play with slugs or coins.

SPIN AND BRAKE MECHANISM is shown separately in simplified drawing at right. Angle of view is same as for complete machine (above). Operating lever (far left) is shown half pulled, twisting pivot bar. This has stretched both latch and drive springs. Both are released when lever is pulled down rest of way. Drive spring then twists bar back and connecting lever system makes drive pawl kick three notched disks. Each of these is fastened to one of three drums on concentric axles, so drums now spin. Meanwhile latch spring runs clockwork that pulls over latch bar. As this moves, foot of each stop lever slips in succession off its edge, allowing small spring to pull stop pawl at other end forward into a star wheel, stopping a drum. As each star has only 10 points, only every other symbol can come up at window. Machine can be "fixed" by weighting drums so few pay-off stops are made. Also, points of star wheels can be greased or filed away.



eight to one against its ever coming up.

The ingenious mechanism that sees to all this hasn't changed very much since the Gay Nineties when a fellow named Charles Fey invented the first slot machine out on San Francisco's Barbary Coast. The customer works it by inserting a coin and pulling a lever. This does five separate things:

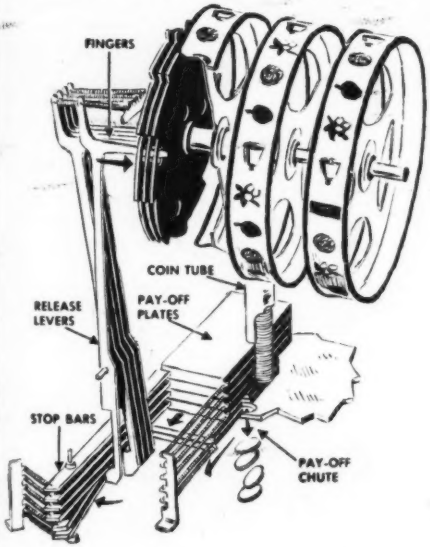
- It powers a spring that spins the drums.
- It powers a gear train that sets brakes to make the drums stop in the same order every time.
- It sets a mechanism that sorts the money among a pay-off tube, the jack pot and the house cash tray.
- It makes the pay-off, if any, of just the amount indicated by the window symbols.
- And at the end, it resets the entire mechanism for the next play.

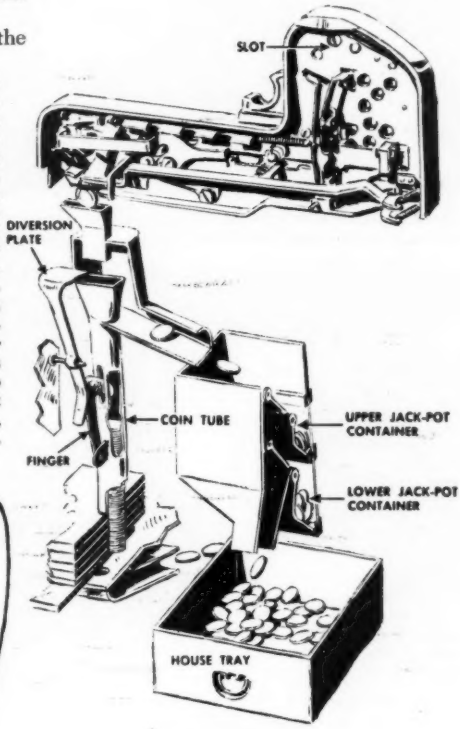
Making these clever devices has grown into quite an industry since Fey's day. In 1947 for example—up-to-date figures are impossible to get—10 manufacturers of what they like to call "bell-fruit machines" shipped more than 49,000 slots, worth about $16,000,000 retail.

But this is small change compared to the profits of the men who own and operate the

[*Continued on page 238*]

PAY-OFF MECHANISM, simplified, is shown below. Each of three notched disks is on same axle with one drum. When a drum stops so that a pay-off symbol shows in window, connected disk stops so that a hole in it is opposite one of fingers at left. When two or more pay-off symbols line up in proper sequence, holes in disks line up so that one finger can be spring-pulled to right. This moves foot of release lever to left, kicking over one or more of horizontal stop bars. Movement of bars allows same number of slotted pay-off plates to be pulled back by springs. Each of bottom two plates carries two coins; other four plates carry four coins each. Coins are brought from column in coin tube to pay-off hole and drop through. Jack pot releases all 20 coins in pay-off plates, opens one of special jack-pot containers.

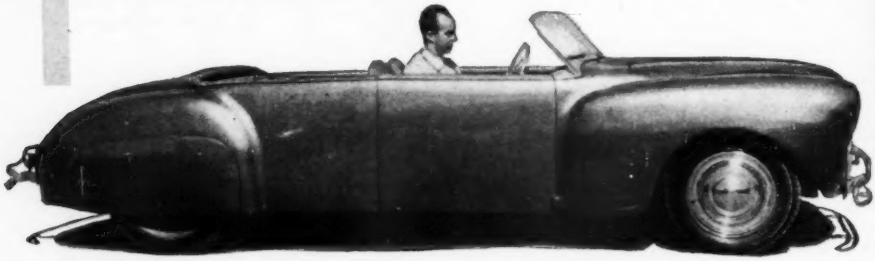




COIN-SORTING MECHANISM is shown in simplified form above. When player drops coin in slot it releases brake (not shown), allowing operating lever to be pulled. This makes fingers move coins to left along top track until one drops into coin tube. When coins have filled tube they push out finger that in turn pushes out bottom of pivoted lever. This moves diversion plate on upper end of lever forward, blocking coin tube. Hereafter coins slide down chutes to two jack-pot containers. When these are filled, their trap doors jam, coins slide into house "take."

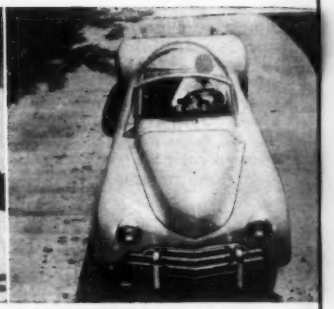
"High-Hat" Hot Rods Combine

THIS eye-catching conversion of a '41 Ford Club Coupe, hardly four feet high, is what Bob Trammel, North Hollywood, Calif., body worker, wound up with in his attempt to combine streamlined beauty and top performance with the ease of a family sedan. The Mercury engine kicks up 206 horsepower for high-speed cruising.



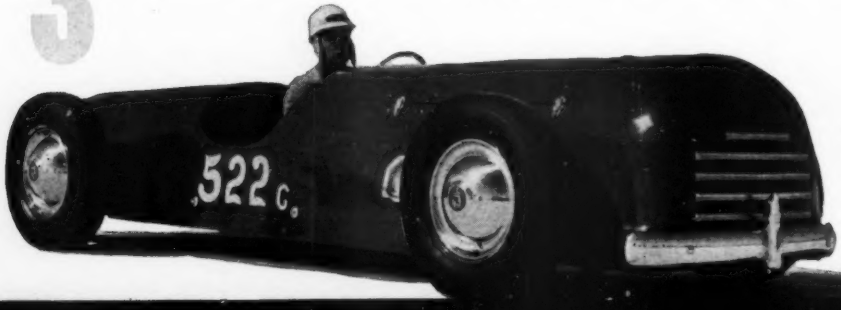
DETACHABLE BUBBLE TOP of clear plastic snaps into place quickly. It was once the upper half of a bomber's nose. Note that there's no door on left side of car.

SEPARATE BUMPERS, shaped from steel, are placed vertically. Tail lights are aircraft wingtip-light covers. The roadster cost Davidson around $1,500; he has refused $3,000 for it.



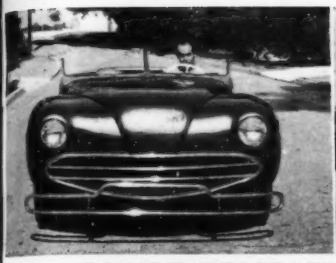
BODY'S UNUSUAL TAPER to a wide end is shown in view from above. To learn welding, 23-year-old designer got a job as apprentice in a sheet-metal shop.

THE neighborhood kids call this sleek speed wagon "The Jelly Roll" because of its elongated shape and maroon paint job. Woodrow Janson of Cedar City, Utah, wanted a luxury car and a high-velocity vehicle with a racing body—all on the same set of wheels. His dream came true in this 1,564-lb. custom job. She'll top 130 m.p.h.

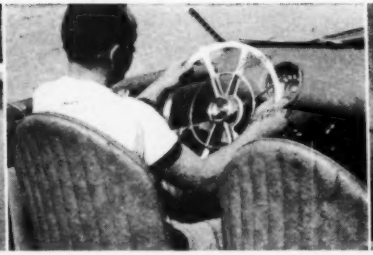


Speed and Comfort

These homemade honeys are whistle-bait for custom-car fans wherever they go—but that's only half their charm.



TUBULAR BUMPERS SET LOW and hand-formed grille emphasize the car's ground-hugging lines. Wheelbase and tread are only dimensions left unchanged.



CAR IS UPHOLSTERED IN LEATHER over foam rubber. Its brown and tan interior looks well with the metallic-blue body. A speedometer is the only instrument on the padded front panel.

ROD MOVES BUCKET SEATS fore and aft, tilts them to suit. Lowering floor nine inches below frame raised drive shaft into body—it makes a handy arm rest.

THREE and a half years of Californian Stanley Davidson's spare time transformed a hodgepodge of auto and airplane parts into this motorized masterpiece. Main ingredients: '48 Caddy grille, '46 Olds hood, '38 Plymouth front fenders, '40 Buick Super rear fenders. 126-inch-wheelbase chassis is '40 Mercury—engine a souped-up '41 Ford.

Photos courtesy of *Motor Trend*

BLUNT CONTOUR OF NOSE was formed by tack-welding and riveting parts of fenders. Front axle was narrowed to help car hold the road at high speed.

AN IMPOSING ARRAY OF GADGETS, dials and instruments adorns chromed-steel panel. Soft, thick gray carpet covers floor. Car has standard gearshift, hand-braking for rear wheels.

POWER PLANT is a 1950 Ford truck engine—beefy enough for reboring with plenty of metal left in cylinder walls. Hose feeds gas to three carburetors.

Trouble Is Their Pastime

"The most hazardous noncombat flying" is just a hobby to puddle-jumper pilots of Civil Air Patrol rescue teams.

By Joseph Stocker

SHOCKED and blood-smeared, two young Air Force officers surveyed the carnage about them—chunks of a crashed B-50 bomber still giving off clouds of black smoke, and the blackened, broken bodies of their 12 crew mates. Ruefully they calculated their chances of being found on the remote and desolate sweep of western desert that seemed like the very edge of the world.

Then their ears caught the wonderful music of an airplane engine. They scanned the sky. Plodding stoically up from the south, low over the ground, came a humble puddle jumper.

CAP to the Rescue

The civilian pilot circled, looking for a clear spot amidst the cactus and mesquite. He landed and, a few minutes later, flagged in a passing Navy trainer. Then each plane took off with a survivor.

The puddle-jumper pilot responsible for the rescue was a member of the Civil Air Patrol. And this is the sort of thing the CAP does almost every day as America's foremost organization of aerial bird dogs.

Search-and-rescue, the CAP calls it. But CAPers themselves have a more relaxed term. Comes news of an airplane missing, a hunter vanished into the snowy wilderness, a child lost in the mountains, and the word goes out that "the big flap is on."

Bookkeepers bang shut their books and leg it for the airport. Storekeepers turn their stores over to their clerks. Lawyers

Then their ears caught the wonderful music of an airplane engine.

A LARGE RELIEF MAP in the headquarters of the Tucson, Ariz., Civil Air Patrol squadron helps officers set up coordinated flight plans for search-and-rescue missions.

THE BIG FLAP IS ON. From the cockpit of his little single-engine craft, an eagle-eyed CAP pilot scans the rugged Arizona terrain below him for signs of a crashed plane.

gallop out of their offices past waiting clients, and doctors reschedule their patients.

These and a hundred thousand others—bartenders, stenographers, salesmen, ex-GI pilots who flew with Doolittle, and strictly Sunday flyers who never touched the stick of anything hotter than a Cub—these are the aerial bird dogs of CAP.

They are proving themselves as useful in peacetime as in the early days of World War II, when the newly organized CAP hunted Nazi sub packs besieging our coasts.

Find Lost Skiers

One winter week end, two skiers from Los Angeles wandered off into California's wild San Bernardino Mountains and became lost. Panic, exposure and hunger had them pretty well whipped next morning when suddenly a CAP search plane buzzed in out of the gray murk and waggled its wings cheerfully. The plane radioed their location back to its base and a few hours later a ground party picked them up.

In New Mexico a big Air Force plane splattered itself across a 13,000-foot mountain in midwinter. One crew member was killed but nine survived. For two days they crouched on the crest of the mountain, tortured by the blast of a cold wind that stung like a million icy needles.

On the third day, a two-place Taylorcraft puttered leisurely in from the northwest and circled less than 200 feet over their heads. It was a search plane from CAP's unit at Alamosa, Colo.

Then began an exhibition of flivver flying that survivors of the bomber crash talk about to this day.

The pilot circled low, dropping food, blankets and cigarettes. On one pass he cut his engine to yell, "Hang on! Help is on the way!" Then he flew back to his base, reported the crash location, took on another load of supplies and returned to the mountain.

Six Trips in One Day

This time he spied a saddle of ground not far away from the waiting fliers. The pelting wind had swept it clear of snow. "I'm going in," he announced impassively, and proceeded to do just that. The altitude was 12,800 feet. The CAP men came back six more times that day and landed to deposit supplies. Next day a ground party reached the shivering survivors.

Lost planes and lost people account for a goodly number of Civil Air Patrol's "big flaps," but by no means all of them.

Oklahoma City CAPers, for instance, went big-game hunting—to find a footloose leopard that hopped the wall to try life outside the zoo and scared the pants off the townspeople.

On occasion, however, the CAP can be a dumb animal's best friend. There was the Mississippi farmer's Jersey cow, heavy with calf, that crashed through a fence, swam a river and disappeared into a swamp. The farmer hunted for two days and finally called the CAP. In 20 minutes a plane had spotted bossy and, beside her, teetering on

[*Continued on page 242*]

GROUND CREWMAN signals a CAP pilot to taxi into position as he returns to base for refueling. On search-and-rescue missions, the Government foots the bill for gas and oil.

DESERT STRIP at Lake Havasu, Ariz., is the bustling base of one of the 1,500 CAP units scattered throughout more than 1,000 communities in the United States.

Circling low over the crashed bomber, the CAP pilot dropped food, blankets and cigarettes.

Four Lanes Painted at Once

WHEN this highway striper makes one trip over a road, four lane markings are painted in place at one time. A 30-foot boom on the rear of the vehicle is adjustable to various widths so that a double center line and two single lines are laid down. A periscope-like device enables the driver to hold a straight course. Skip stripes can also be laid down by this machine, which was invented by Sgt. Carl G. Sohmer of the Tacoma Police Department.

New Plane Totes More

MEET the Convair-Liner 340. Newest and largest twin-engine transport, it carries a ton more payload faster and higher than Convair 240. It is fitted with 2,400-horsepower Pratt & Whitney reciprocating engines, but turboprop engines can be installed.

Visor Deflects Rain

THIS plastic visor cuts side glare and lets you drive with window open even in the rain. It is made by Tenna-Lite Corp., Chicago.

'52 Pontiac Has New Power Train

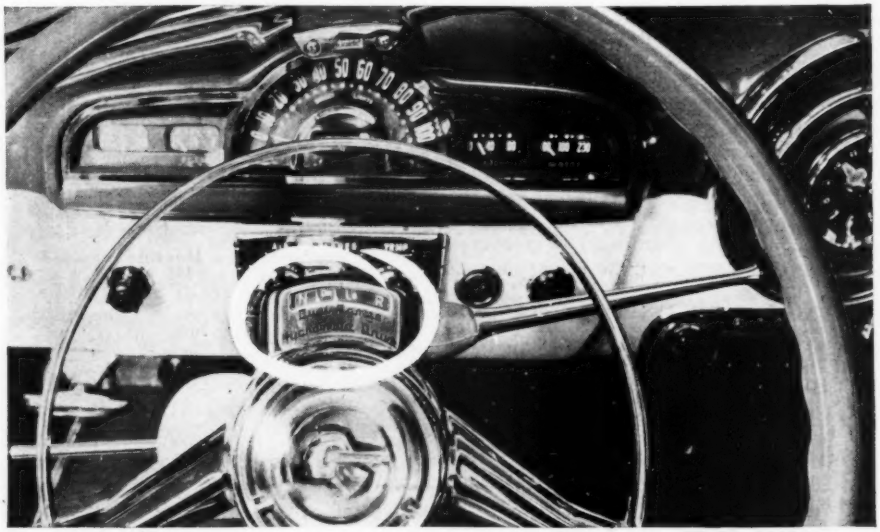
A third-gear range on Hydra-Matic lets you pick the rear-axle ratio.

By Harry Walton

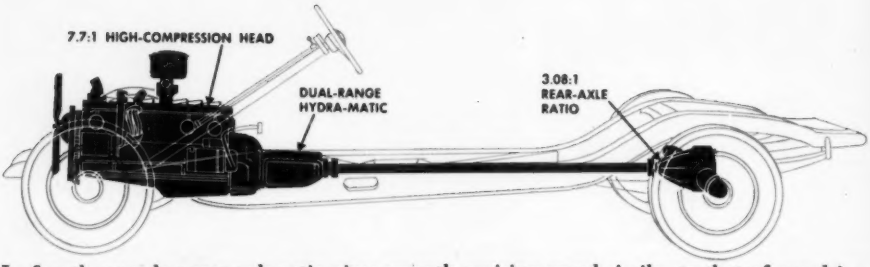
PONTIAC, in 1952, offers a new Hydra-Matic drive that gives the motorist back a piece of the shift lever he lost with the clutch. He'll be able to scoot along in a higher, gas-saving fourth gear, and shift to third at the flip of a finger when the car crests a hill. He will, in effect, have a choice between two rear-end ratios.

Previewed by Wilbur Shaw last year (PS, Oct. '51, p. 128), the Dual-Range Hydra-Matic makes its bow as optional equipment on the 1952 Pontiacs. Also new are a high-compression head and a low-ratio rear axle.

With the improved drive, Hydra-Matic users need not choose between coasting downhill in fourth and using the brakes heavily, or shifting to Low range. The latter meant shifting from fourth gear to second,



Two arrows flanking Drive position on the selector quadrant are tip-off to Dual Range.



In fourth gear, low rear-axle ratio gives smooth cruising speed similar to that of overdrive.

which made the car "pile up" against the engine and induced skidding, besides adding too much engine drag for highway grades.

Now, you just nudge the selector lever from the left side of the Drive position to the right. The transmission will shift to third gear instantly, and will not go back to fourth until you move the selector lever back.

This optional third-gear position makes possible a lower rear-axle ratio—3.08 to 1 instead of 3.46 to 1. In fourth gear, which is a straight-through 1 to 1 drive, this low ratio amounts to an overdrive. The shift to third instantly drops the over-all ratio to 4.46 to 1.

Tramp on Gas for Other Shifts

Downshifting to third is also possible, at speeds below 60, by floorboarding the gas pedal. In the right-hand Drive position, at speeds below 20 miles an hour, tramping on the gas makes the transmission shift to second. A larger detent lets the driver feel the downshift point more clearly.

Also new is the action in Low range. The car starts—and stays—in second gear when the selector lever is at Low. This makes for surer starting on ice. Tramping on the gas below 10 m.p.h. will shift to first gear.

An exhaust valve added to the rear servo unit facilitates the shift from low to reverse, making it easier to rock the car in snow or mud.

As part of its Hydra-Matic power package, Pontiac specifies a new 7.7:1 high-compression head, said to boost maximum horsepower of the six to 102, and of the eight to 122. Engines with this head require premium fuel. The 1951 high-compression head gave a ratio of 7.5:1.

The compression ratio of the standard Pontiac head, recommended for Synchro-Mesh shift, has also been upped from its 1951 figure of 6.5 to 6.8:1.

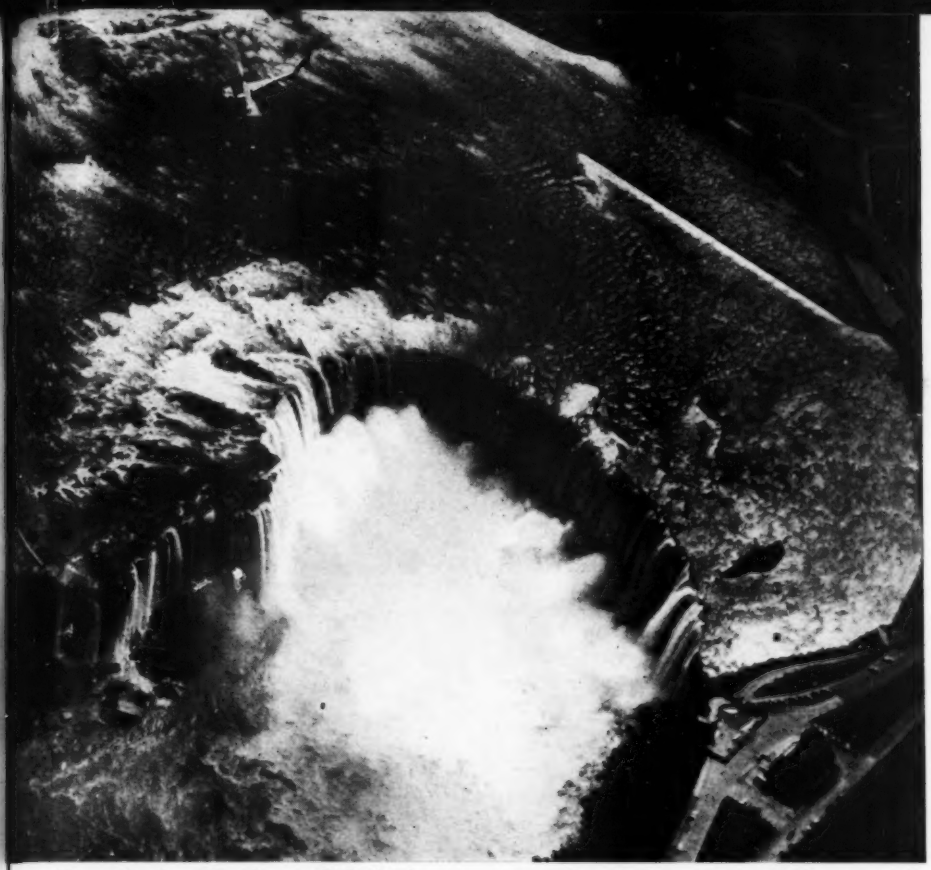
Minor engine changes include improved spark plugs and a redesigned generator, with a new lubrication system that is said to prevent the danger of over-oiling.

Wheel disks, the trunk handle, hood ornament and radiator grille are of new design. Some new upholstery and body colors will be offered, including three color combinations in trim in the De Luxe models. Extras include tinted safety glass all around and a motor-driven radio antenna. END

75 years ago this month

Popular Science Monthly reported:

"THE loss, in 1875, to Russia, from the ravages of wolves, amounted to about 15,000,000 rubles. The number of cattle killed was 179,000; of sheep, etc., 562,900. In the government of Kalouga alone the wolves killed 8,200 geese and 2,000 dogs. The human lives destroyed by the wolves are estimated at 200 per year."



Niagara's familiar face will look the same even though less water will flow over it.

How Niagara Falls Will Work Nights

U. S. and Canada plan to squeeze more power from the scenic attraction by siphoning off some water when the tourists aren't around to see.

By George H. Waltz, Jr.

THEY'RE going to run the Niagara River through a "faucet" to generate enough extra electricity to serve the needs of five million U. S. homes. Canada's homes and industries will benefit in a big way, too.

Although this new project means tampering with the flow of water over Niagara Falls, nobody's honeymoon is going to be spoiled, for it will be done mostly when few sightseers will be around.

The proposed faucet will actually be a dam with control gates, located either a short distance above the Falls or where Lake Erie spills into the Niagara River, at Buffalo. New hydroelectric plants on both banks of the river (which at this point is the boundary between the two countries) will turn the extra water power into electricity to meet the rising demands of both the United States and Canada.

About a year ago, the two countries decided they could siphon off some water

from Niagara Falls without spoiling its looks. When the rainfall is normal, some 170,000 cubic feet of water goes over the Falls each second. Experts agreed that was around 70,000 cubic feet a second more than it needed to look pretty.

After making careful surveys and tests, including experiments with scale models of the Falls, U. S. and Canadian engineers decided to cut the flow to 100,000 cubic feet a second during the daytime in months when people flock to see the famous show. At night and during the time of the year when tourists aren't on hand, they plan to clip it to 50,000 cubic feet a second. The rest of the water will be diverted and used ingeniously to make more electricity.

U. S. Water Bonus Is Big

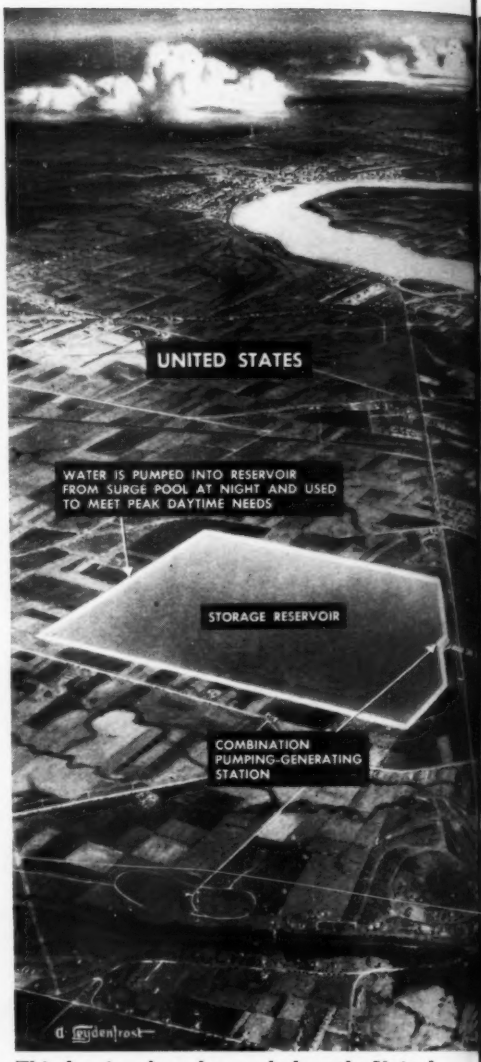
The U. S. share of this prized dividend of water will boost our generating capacity at the Falls from the 440,000 kilowatts we have now, provided by two fairly small hydroelectric stations, to at least 1,572,000 kilowatts. We plan to build a super hydroelectric plant at Lewiston, N. Y., on the Lower Niagara River six miles downstream from the foot of the Falls.

The plant will have two banks of turbine-driven generators—six 20,000-kilowatt units and twelve 90,000-kilowatt units. They will get their water by separate routes. The 20,000-kilowatt units will draw on the Lower Niagara River below the Falls. Here water will enter a tunnel 42 feet in diameter and a little more than three miles long and be pushed along to a surge basin at the Lewiston power plant. There the 20,000-kilowatt generators, operating under a 100-foot head of water, will turn out 120,000 kilowatts of electricity.

Reservoir to Cover 850 Acres

The 90,000-kilowatt units will get their water from two sources—the Upper Niagara River and an unusual 850-acre storage reservoir which will be built a mile east of Lewiston. Tunnels five miles long or canals somewhat longer will bring water from a point a few miles above the Falls to a surge basin at the power plant, where it will provide an operating head of 315 feet.

By a clever arrangement, the huge storage reservoir, which is to have a plant that can both pump water and generate electricity, will use power when there is power to burn and then furnish both water and electricity when they are most in demand.



This drawing shows how and where the United

At night and over week ends, when factories generally are not running and it will be all right to tap the Upper Niagara to the limit, the pumps will suck up as much water as the reservoir will hold. During the daytime on weekdays, the stored water will be doled out through the reservoir's pumping-generating units as needed, serving two purposes. Under an average water head of 60 feet, it will generate up to 130,000 kilowatts of electricity. It will then be

States and Canada will tap the Niagara River to get more electricity for both nations.

fed to the main Lewiston power plant to help drive the 90,000-kilowatt generators.

Canada is already at work on its part of the big new power project. What the United States has cut out for itself will cost about $350,000,000 to build if tunnels are used to bring water to the Lewiston plant, somewhat less if canals are used. But the experts say that it will pay off with around $61,000,000 worth of much needed electric power every year. END

When to Do What

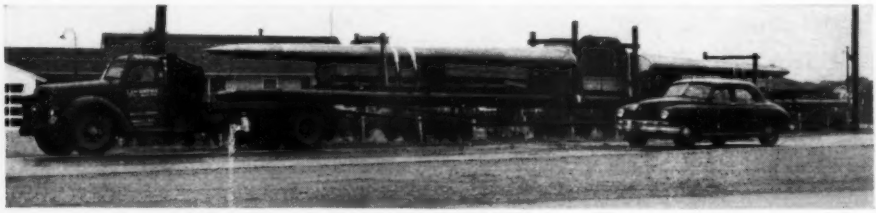
THERE'S a secret to keeping up a home: *timing*. What's the best time to check for fire hazards? To inspect the hot-water tank? To cut posts? Turn to page 171 for POPULAR SCIENCE'S new—

Home Handyman's Calendar

Piston Rings on New Chrysler to Lengthen Engine Life

SIX-CYLINDER models of the 1952 Chrysler, announced last month, have new chromium-plated top piston rings to eliminate scuffing and reduce cylinder-bore wear by as much as half. A new type of oil ring, giving better oil control, is expected to add considerably to the life of the engine. Horsepower has been boosted from 116 to 119.

The new line of Chryslers looks much like its predecessor. Above: the eight-cylinder New Yorker four-door sedan. Wheel covers and tail lights have been restyled. Tinted windshields and windows are available at extra cost. Power-assisted steering can now be purchased as an extra on Windsor six-cylinder models.

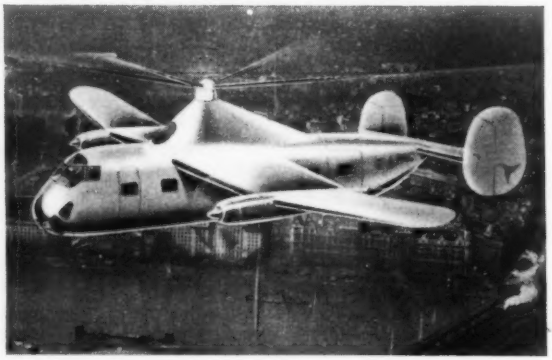


Big Trailer Hauls Plane Tail

THIS trailer is so long that a helper must run back and adjust the rear wheels whenever the driver wants to turn. Its owners had to get a special state ruling before the overlength, 91-foot unit could roll on Texas highways, hauling horizontal stabilizers for huge B-36s to the Convair plant.

British Building New Helicopter-Plane

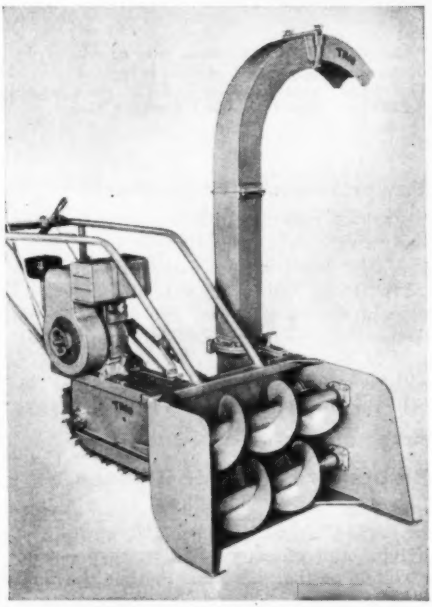
ENGLAND'S version of a helicopter-airplane is the Fairey Rotodyne, shown in artist's sketch at right. Main power will come from gas turbines turning propellers. Air bled from the turbines will be fed to rotor-blade tips where it will be ignited in auxiliary ramjet units. The rotors will supply emergency power and give the aircraft a steeper take-off.



Tiny Fire Truck Guards New Cars

A MIDGET fire truck stands guard against any outbreak of fire as these new cars are filled with gasoline in Ford's Dearborn assembly plant.

Because of its small size, the fire truck can be driven right into the building. It is similar to the trucks used to haul materials in factories, but here carries an assortment of extinguishers including two Kidde CO_2 units.



Crawler Plow Blows Snow Away

THIS husky snowplow on a caterpillar track cuts a 30-inch swath through the deepest drifts—and all the operator has to do is guide it by the handlebars. Powered by a 7.7-hp. gasoline engine, the plow has a blade across the front that scoops up the snow and rotating augers that bite into it. A fan blows the snow away through a six-foot spout that can be swiveled in any direction. Dahlman Equipment Sales Co., St. Paul, Minn., sells the plow.

Wooden Track Frees Mired Car

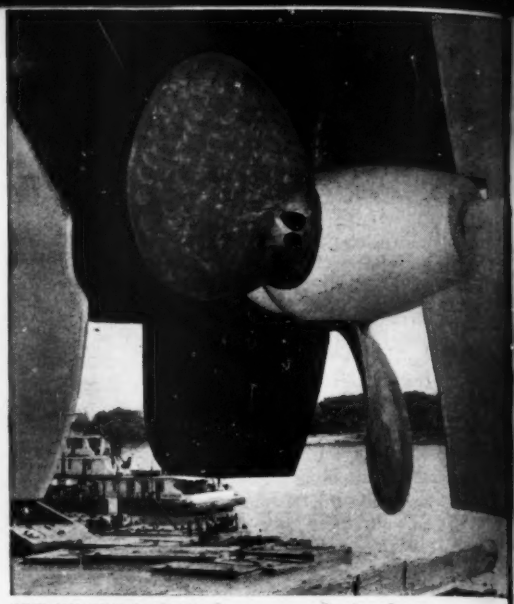
THIS heavy wooden track, tossed in front of the wheel that's spinning, gives the traction needed to free a car bogged down in snow, mud or sand. The Consolidated Equipment Corp. of Cleveland makes it.

Rod to Halt Rust in Car Radiator

THE metal rod at right is intended to be put in a car radiator to prevent rust from forming and keep water sweet and clean. The manufacturer reports that in a few weeks scale will begin to drop away. Then when the radiator is flushed, water remains clear. In a new car, any scale that forms becomes sludge that drops to the bottom. The maker, McRay Products Co., Los Angeles, claims galvanic action does the job.

New Tug Pushes Floating Train

OL' MAN RIVER is to see something new—fast streamlined "trains" afloat. Tank barges for petroleum products, and a towboat that pushes them, have been especially designed to form an integrated unit. To make up a 1,180-foot "train," four barges fit together end to end, and "wings" or fairing hulls extend from the aftermost barge around the prow of the towboat. Developed in model-basin tests by Lake Tankers Corp., New York, the floating streamliner's design minimizes water resistance and boosts speed against the current. The first of the towboats, the *Delta Cities,* has just been launched at St. Louis.



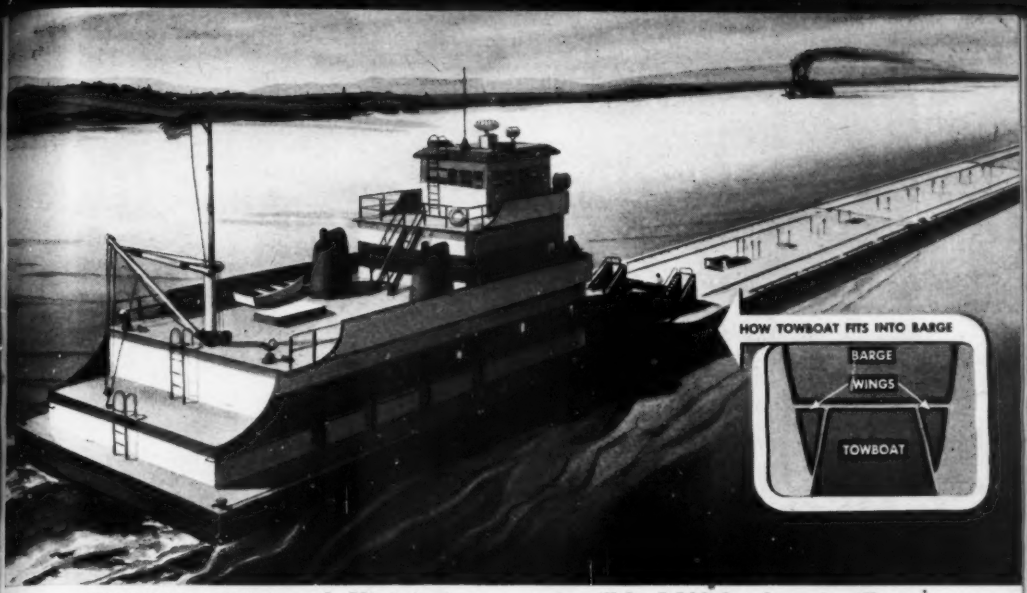
PRELAUNCHING VIEW shows one of nine-foot-diameter, stainless-steel twin screws, believed largest of variable pitch in U. S., that propel 3,200-hp. Diesel towboat *Delta Cities.*

Tower Jounces Plane Parts

ENOUGH cocktails for a regiment could be shaken at once in the 40-foot tower (left) that tests big fuel tanks and other aircraft parts. It can jounce 3,000-pound pieces 15 times a second as far as five feet. The big bumps come from elastic shock cords actuated at top and bottom by pistons driven with compressed nitrogen gas. Built by Bell Aircraft Corp., Buffalo, N.Y., the tower is the first of its kind.

Binoculars Fit Over Glasses

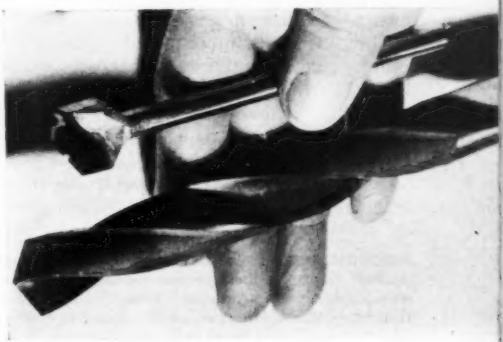
DESIGNED for people who wear glasses, the binoculars below have a forehead rest giving ample clearance. The optical system is suited to that position—so that the field of view is not reduced, as it is when an eyeglass wearer is forced to hold ordinary binoculars away from his eyes. The maker is Barnet Ensign Ross Ltd., London.



STREAMLINED "TRAIN" to ply Mississippi consists of four barges and towboat pushing them. Prow of towboat fits between "wings" flexibly joined by pins to barge ahead. Since train will be 1,180 feet long, it will need a microphone at forward end to pick up whistles of oncoming craft, with wires leading back to loudspeaker in pilot house of towboat.

Drill Races Through Plastics

LIKE a hot knife in butter, a new drill with a straight round shaft sinks right through plastics. It far outspeeds and outlasts the conventional drill shown below it at right, which must be fed slowly to avoid overheating. The new drill was designed by Robert Double, Westinghouse engineer.

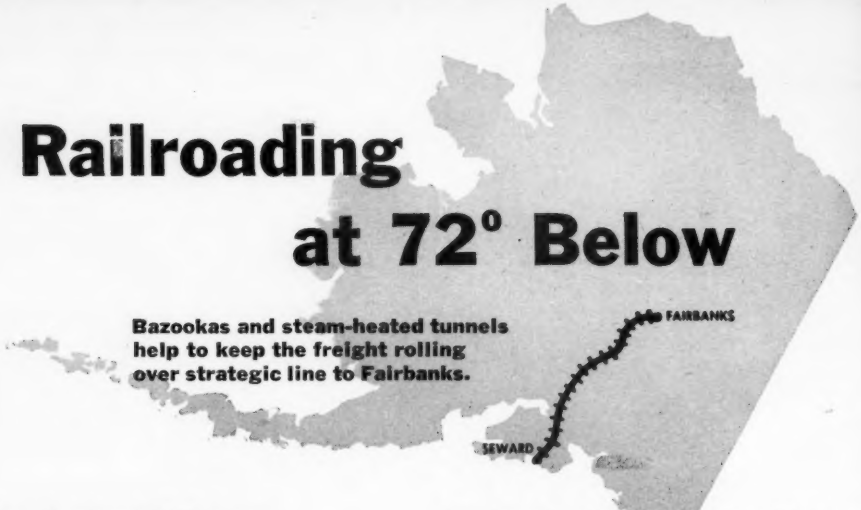


Builds His Own Sports Car

INTO the sleek job below went a Mercury engine, a Lincoln transmission, Ford wheels, a Chevrolet gas tank, an aircraft instrument panel, about $1,100 and two years' spare-time work by Bill Houk, Boeing Aircraft machine-shop foreman at Wichita, Kan. He built the body himself. The 160-horsepower car will do 110 miles an hour.

Railroading at 72° Below

Bazookas and steam-heated tunnels help to keep the freight rolling over strategic line to Fairbanks.



By Herbert Yahraes

TEMPERATURES that drop as low as 72° below zero at this time of year and snowfalls that may total 50 feet for the season often delay—but never stop—the Alaska Railroad.

Some of its main problems and how it meets them are shown on these pages.

Only two remain unsolved. One is the problem of the immovable moose—see below. The other is the moving mountain—a vast, shifting mass of rocks over which an 11-mile stretch of line has to be rebuilt each year.

Newest weapon used against the moving mountain is the bazooka. When a rock slide buried 165 feet of track and left an overhanging cliff that looked as if it would topple on the track at any moment, the railroad—run by Uncle Sam—called on the Army for help.

Bazooka teams poured rockets into the cliff to bring down the dangerous-looking overhang so cleanup crews could safely clear the tracks. Instead, the bombardment proved that the rock was going to stay up there a good long time. Two days later the line was clear.

The Army's help symbolized the Alaska Railroad's high strategic importance. It is now hauling more freight across 500 miles of our northern outpost than it did even during the peak years of World War II.

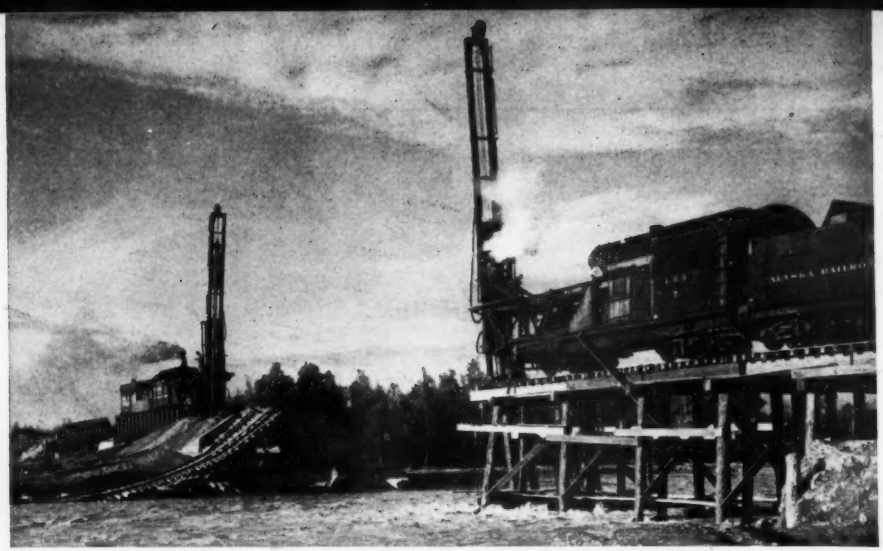
MOOSE ON THE TRACKS (below) often block traffic. They get on the snow-cleared right of way and refuse to leave. One theory holds that they think the locomotive is a big wolf—which they can outrun only in the open. Last winter trains killed more than 175 moose.

STEAM-HEATED TUNNELS carry Alaska Railroad through half a dozen mountains. Gatekeepers swing huge doors open to let trains enter and leave. Steam pipes from a boiler prevent seepage from freezing into giant icicles that would shake loose and drop on cars.

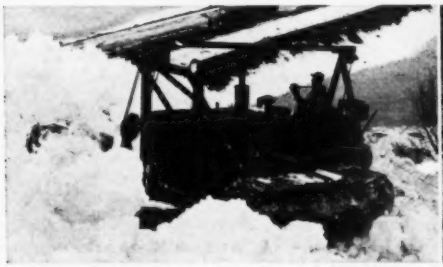
SNOW SLIDES buried three men alive when they tried to escape from the snowbound freight above. Here a gang of men digs them out. A trainman, William R. Shake, won the Distinguished Service Award, the Department of Interior's highest honor, for this rescue job.

HEAVY SNOWS—50 feet may fall in a season—crushed the roof of this warehouse in the terminal yards at Anchorage. In some spots where the line runs along mountain valleys, huge snowsheds have been built to carry avalanches over the tracks. In unprotected sections bulldozers, and snowplows propelled by locomotives, are used to clear away the snow. Sometimes a snow slide rips up wire lines along the route, disrupting communications and causing expensive delays.

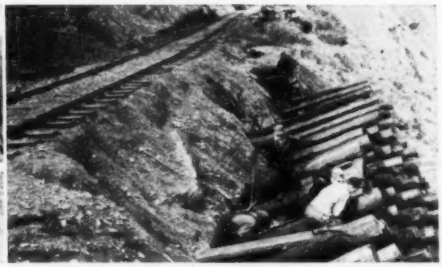
(Continued on next page)



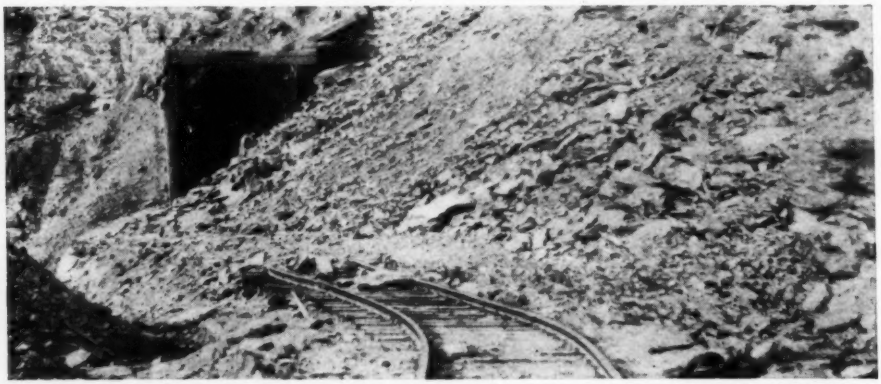
FLOODS swept away the Kashwitna River bridge, shown being rebuilt by pile drivers above. Spaces between ties on a span like this are often covered with metal plates to prevent moose—who like to run on the tracks—from breaking their legs.



AVALANCHES that drag along trees and rocks are cleared away by bulldozers. Machine above works on a slide far up the mountain to prevent it from descending on the tracks.

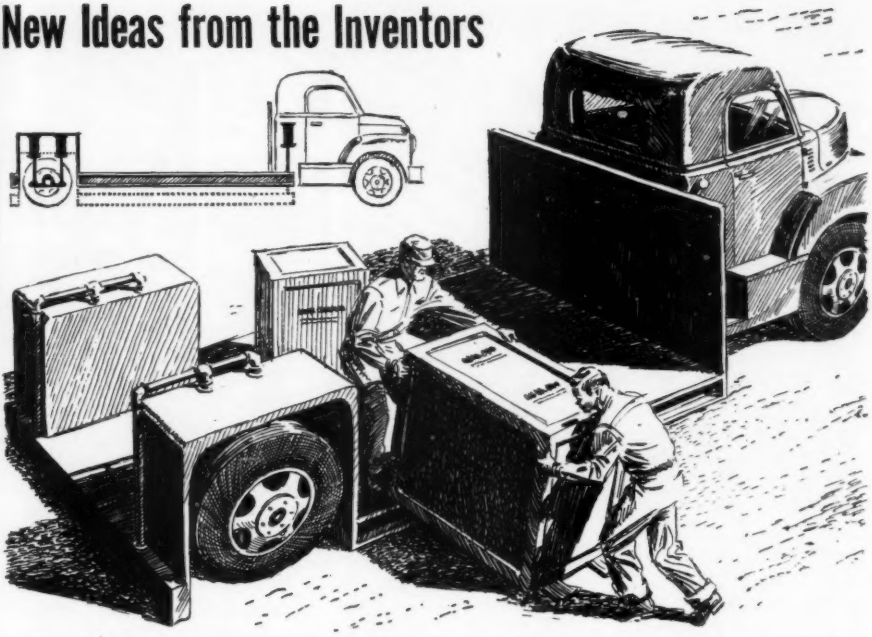


SIXTY-FOOT PILINGS, pounded into the roadbed at an angle (above), help to support track on thawing mountain as soil shifts. This section of track has to be rebuilt each year.

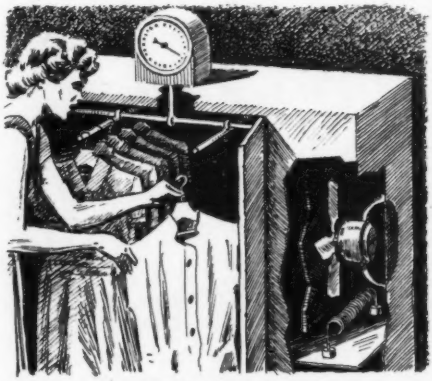


A ROCK SLIDE in the area of the moving mountain blocks 165 feet of track. To prevent another such slide, Army bazooka teams blasted away at an overhanging rock cliff. Rock stayed in place, proving that cliff would hold and it was safe for crews to clear tracks.

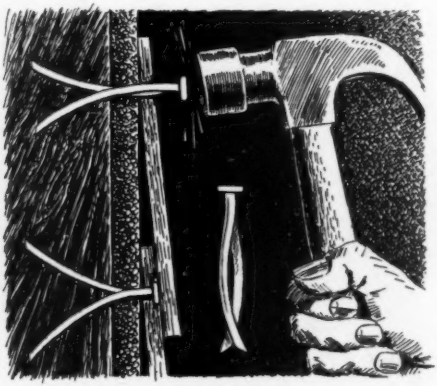
New Ideas from the Inventors



1 Truck Body to Lower. To avoid raising heavy cargo up to a truck, this invention would bring the truck right down to the cargo. A hydraulic system, controlled by a button in the cab, would lower the entire truck body to curb level for easy loading, then raise it for road travel. Front-end-drive eliminates a driveshaft that would otherwise get in the way. The body could be locked at any level.



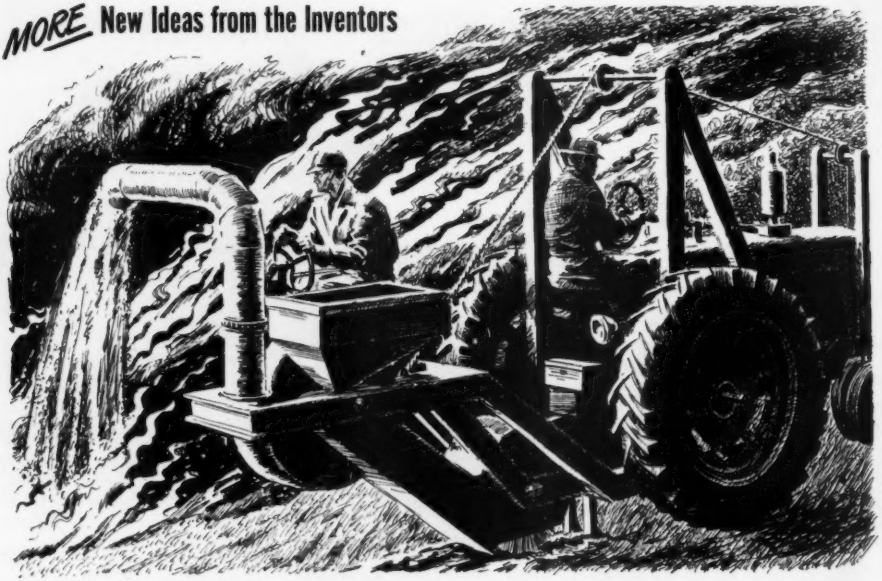
2 Drier to Weigh Clothes. A housewife would have no trouble wondering when to take the clothes out of this laundry drier. A sensitive scale, connected to the rods holding the clothes, would weigh the garments as water was removed to show when they were dry. The drier would combine heating elements with a fan to circulate air.



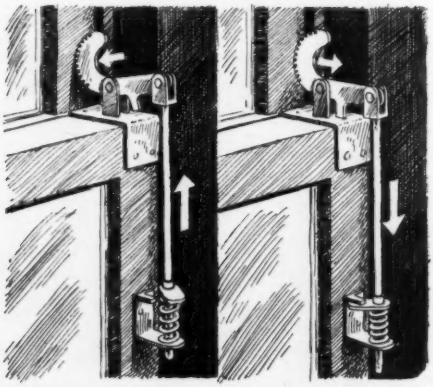
3 Nail to Lock Itself in. Once you put this nail in, it would be in to stay. As you drove it, the slightly curved twin points would spread farther and farther apart, locking the nail tightly in place. The nail is designed especially for outdoor use, such as in shingles and siding that frost and wind frequently pull loose.

Please turn the page for three more new ideas.

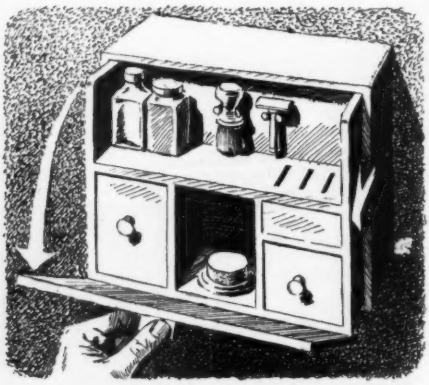
MORE New Ideas from the Inventors



4 Dirt Blower to Smother Fires. When you're fighting fires out in fields and forests, you're likely to have few water hydrants around—but plenty of dirt. This fire fighter would make use of the dirt. Towed by a tractor, the machine would pick up earth on one side with a plowlike scoop, then feed it into a hopper. On the other side a gasoline-driven blower would spray the dirt out of a hose to smother the flames.



5 Window to Lock Automatically. This window would lock itself if you forgot. A toothed cam, mounted on the lower sash and bearing against the upper one, would let both sashes close, but then keep them from opening by wedging itself between the two frames and jamming them. Pulling back the spring-loaded cam would free them.

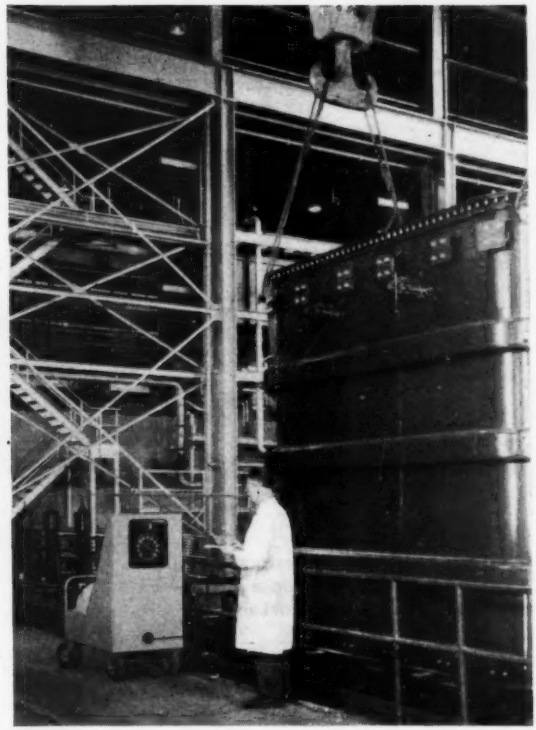


6 Wall Cabinet to Pull Out. Shaving gear and other bathroom needs would pull right out where they are easy to get at with this wall cabinet. The inside, mounted on tracks, would slide out when the door was pulled open. In its opened position, the door would also serve as a handy shelf for holding the articles in use.

Patents on these inventions have been granted to: 1. R. Bill, San Leandro, Calif.; 2. J. Doolan, Edmonton, Alberta, Canada; 3. R. Hallock, Larchmont, N. Y.; 4. J. Hurlbert, Dishman, Wash.; 5. P. Foley, New York, N. Y.; 6. G. Wise, Washington, D. C.

Electronics Weighs Gigantic Machinery

WHILE a giant transformer dangles from a mighty crane, a dial on a little wagon (right) tells its weight at a glance—98 tons. Electric strain gauges in the massive crane hooks are wired to the cart, devised by GE engineers to measure weights beyond the capacity of ordinary scales.



Spray Renews Golf Balls

FOR a gleaming new white coat, just grip a golf ball in the special holder and spray it with this finish. The maker is Federal International Co., New York.

Machine Vacuums Leaves Off Lawn, Chews Them into Fertilizer

RAKING up the leaves of 4,000 trees on the 450-acre University of Illinois campus used to be a six-week job for a dozen men. Now the raking and the bonfires are ended. The tractor-drawn vehicle above, successfully tried out last fall, chews up the leaves instead. A vacuum nozzle picks them up, a hammer mill pulverizes them and a fan blows the valuable, soil-enriching particles back over the ground.

Your first ride in

America's New Light Car

Both economical and lush, the Willys can give you 35 miles on a gallon—and give it to you comfortably.

By Wilbur Shaw and Devon Francis

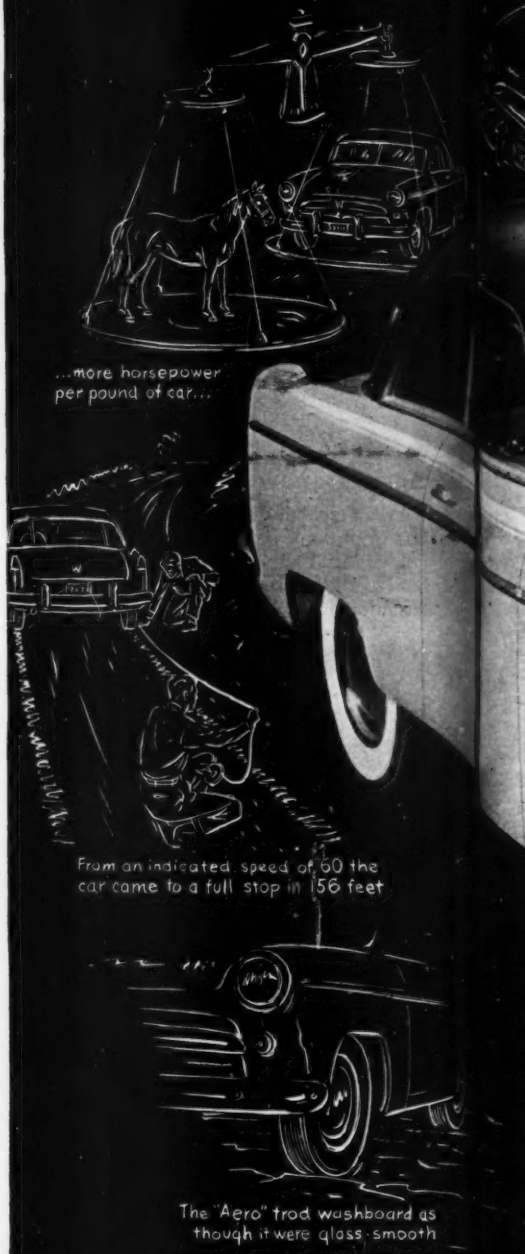
EVER since the war, lean, energetic Ward Canaday, head of Willys-Overland, has dreamed of putting out a light car that would seat six people. Last month he did it. He announced a light automobile that rides like a Cadillac or a Lincoln and gets up to 35 miles on a gallon of gas.

Canaday did even better. He powered his vehicle with a 90-hp. engine having a compression ratio of 7.6:1—second highest in the industry for standard-size cars—and made it run on ordinary, non-premium fuel.

What the design amounts to is a brand-new class of U. S. automobile. Despite a wheelbase of only 108 inches, it does seat six passengers of average displacement comfortably. Front and rear seats are exactly the same width—a roomy 61 inches.

The new Willys has more horsepower per pound of car than anything else in its price class. Its six-cylinder engine develops more horsepower per cubic inch of piston displacement than that of any other U. S. car, regardless of price. At 50 miles an hour in overdrive, it will run for 500 highway miles on one filling of its 18-gallon tank.

It is hundreds of pounds heavier than the other two light American cars, the Nash



...more horsepower per pound of car...

From an indicated speed of 60 the car came to a full stop in 156 feet

The "Aero" trod washboard as though it were glass-smooth

Front and rear seats are exactly the same width-
61 inches
We accelerated to 60 miles
an hour in 20½ seconds
2278
CHICAGO
500 MILES
It took right-angle flat turns at 45
miles an hour without evident sway
...500 highway miles on one
filling of its 18-gallon tank.

AERO ACE MODEL took turns on Speedway at full throttle without evidence of sway. Shaw felt that big single-sheet rear fender might prove expensive to repair.

HERE'S A SURPRISE! Both rear fenders can be seen from driver's seat. On production models gas cap is next to license plate for easy access from either side.

Rambler convertible and the Kaiser-Frazer Henry J, but it is hundreds of pounds lighter than a Ford, Chevrolet or Plymouth.

It's not cheap. It costs considerably more than a Henry J and a bit more than a Rambler, Ford, Chevrolet or Plymouth. Willys' "Aero" car, as they decided to call it, is in the company's own words, a "light, quality automobile."

It was not until we drove this car on the Indianapolis Motor Speedway that we began to appreciate what the man Canaday, then board chairman, meant when he laid down the law to the Willys engineering department two years ago:

"I haven't the slightest idea what it's going to look like when you're through," he said, "but here's what it's got to do."

He ticked off on his fingers what he wanted—economy, performance, quietness, an exceptional ride and, finally, ease of handling.

He wasn't disappointed.

The car has scat. Going through all for-

FACTS ON WILLYS LIGHT CAR

Make and model: Willys Aero Ace series 685 two-door sedan.

Engine: 6-cyl. F-head; 90 hp. at 4,400 r.p.m., car weight per hp., 28.4 lb. (dry); bore and stroke, 3⅛" by 3½"; compression ratio, 7.6:1; piston displacement, 161 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.) 1,889 standard, 1,471 with overdrive.

Crankshaft bearing surface: 34.14 sq. in.

Torque: 135 lb.-ft. at 2,000 r.p.m.

Transmission: 3-speed sliding gear, syncromesh second and third gears.

Rear-axle ratio: 4.1:1 standard, 4.56:1 with overdrive.

Steering ratio: 19.7:1.

Radius of turning circle: 19'.

Effective brake-lining area: 133 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 2,562 lb.; height (full load) 60"; over-all length with bumpers and guards, 180⅞"; width, 72"; wheelbase, 108"; overhang, front 32", rear 40⅞"; tread, front 58", rear 57".

Inside dimensions: seat-cushion width, front 61", rear 61"; leg room, front 42⅝", rear 36¼"; headroom, front 35⅝", rear 34½"; seat height, front 12¾", rear 11¾"; vertical distance, steering wheel to seat cushion with seat in mid-position, 5½"; front-seat adjustment, horizontal 4", vertical none.

Tire size: 5.90 by 15; optional, 6.40 by 15.

LOW, DOWN-CURVING HOOD increases vision, Shaw finds. Both models have two-piece curved windshield. Front seat is split and hinged. Dash lights tell when battery is discharging or oil pressure is low. Turn indicators are standard on custom line, optional on others. All cars come undercoated. Trunk lid is hinged outside to increase space.

ward gears, we accelerated to 60 miles an hour in 20½ seconds. The Willys engineering department had posted a figure of 17½ seconds to 60 and held doggedly to it despite our report from the driver's seat. We're inclined to split the difference with a tuned engine. The car we drove hadn't been touched after a long, hard road test.

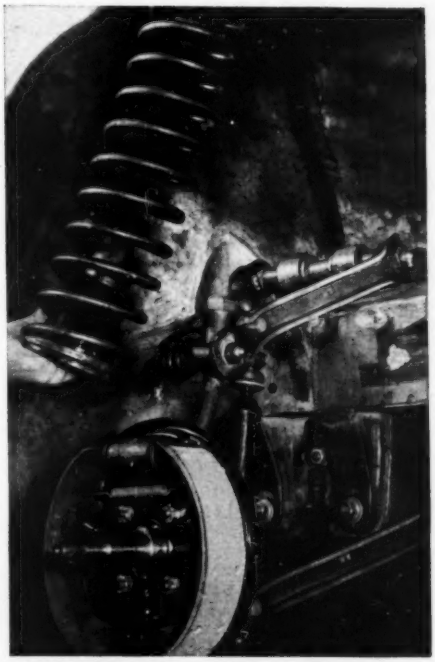
It was the engine that got us. Last year Willys brought out its four-cylinder F-head engine, which has a big overhead intake valve and an exhaust valve in an antechamber like an L-head's (PS, Nov. '50, p. 152). The F-head is now adapted to the new six, and the results are little short of sensational.

Outdoes Even Maker's Claims

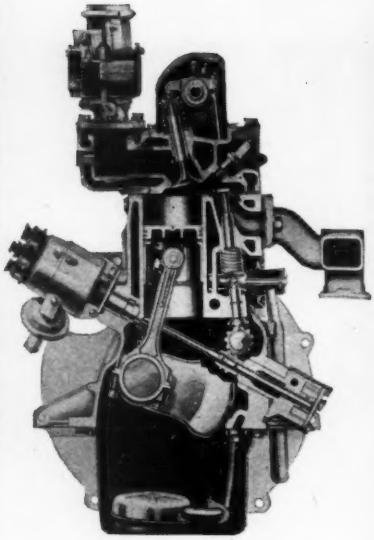
The car walked right on past 60 to 70, then 80 and pegged its speed at 86 in direct drive. The engineering department had stated, with commendable conservatism, that 70 was tops without overdrive. But it wasn't the speed that impressed us most. It was the smoothness of the engine. Whatever vibration it had was effectively insulated from the body.

In overdrive the car did only a little better —89 m.p.h. It cruised beautifully at 75.

Even with ordinary gas, hard acceleration gave no knock. Coasting down to an in-



FRONT SUSPENSION and springing are essentially like Nash Rambler's (PS, May '51, p. 82). Wheel-support members attach directly to the body sheet metal.



ENGINE has intake manifold cast integrally with block to eliminate gasket that might cause leakage. Cutaway (right) indicates position of single rocker arm for each cylinder, and extra-big intake valve.

dicated 10 miles an hour, we put the accelerator on the floorboard. If a "ping" developed, we would have to hear it—the engine operation was that quiet. Two things promptly didn't happen. No jerk occurred as the engine surged. And there was no ping. Just to be sure, we tried it twice more. Still no ping.

Engine Won't Vibrate

The absence of jerking under sudden full throttle was something else again. Here was a car with a direct mechanical connection between the engine and the rear wheels. It seemed to us that there was bound to be some lash in the power train.

Yet both the engine and the power transmission displayed excellent smoothness. Here is why:

The basic vibration frequency of the entire power plant—the one you would get if you could hit the engine like a tuning fork—is below the vibration frequency generated by crankshaft and piston at idling speed. The engine will stall before it vibrates enough to set up any oscillation in its mounts. As engine speed increases, the disparity between generated vibration frequency and the basic frequency of the engine becomes even greater.

As for cushioning the drive, that would be easy if the car had a fluid coupling—the fluid is the cushion. But the Willys has none.

[*Continued on page 240*]

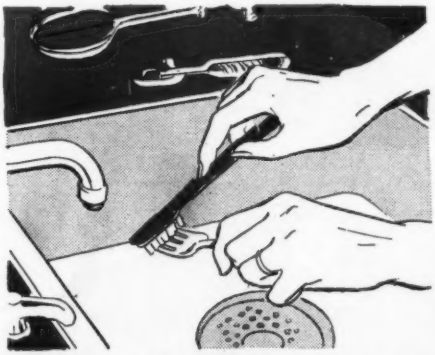
ALUMINUM PISTON (left) has one oil ring (indicated by pencil), two compression rings. Crankshaft (below) has four main bearings. Valves are self-rotating to discourage carbon.

Keeping the Home Shipshape

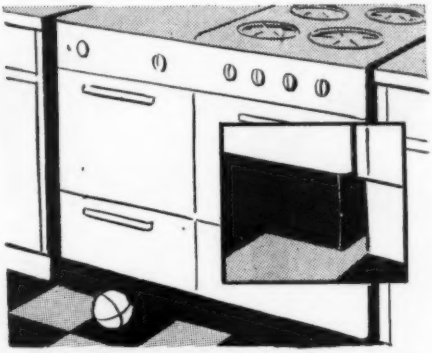
A LAMP FOR LIGHTING THE PLAYROOM FLOOR, or low tables and chairs, can be made from a discarded lamp cut down to four feet. Add a diffusing bowl, if lamp has none.

WHEN PAINTING WALLS, you can protect baseboards by applying masking tape to the tops of the boards and pressing it down flat over newspapers.

AN EMPTY WINDOW-SPRAY BOTTLE, refilled with turpentine or kerosene, is useful in the shop. A few squirts will clean hands that are soiled with paint or grease.



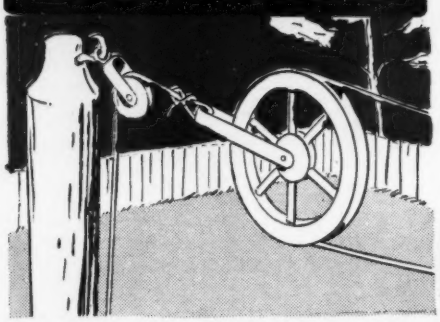
A TOOTHBRUSH IS HANDY for scrubbing fork tines, beater blades, strainers, graters, can openers and other equipment with holes and crevices that a dishcloth won't reach.



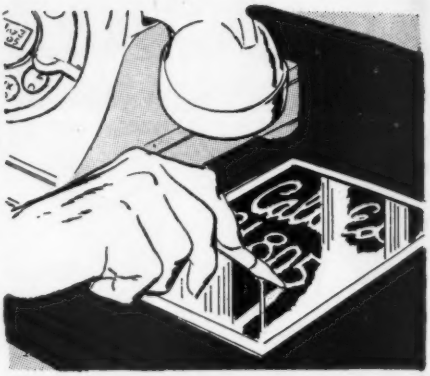
A BASEBOARD at the bottom of the stove will keep toys and utensils from rolling underneath. Drill a hole in each front leg and bolt a piece of plywood across.

Please turn the page for five more suggestions.

Keeping the Home Shipshape

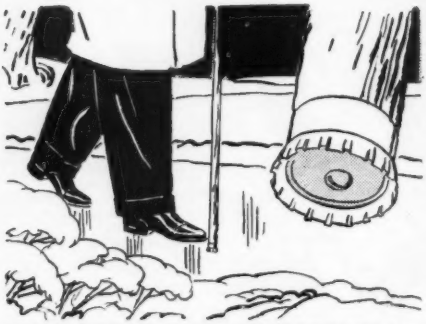


REPLACING A SECOND-STORY CLOTHESLINE is a tough job. Add a second pulley near the top of the pole and you can lower and raise the line pulley easily.

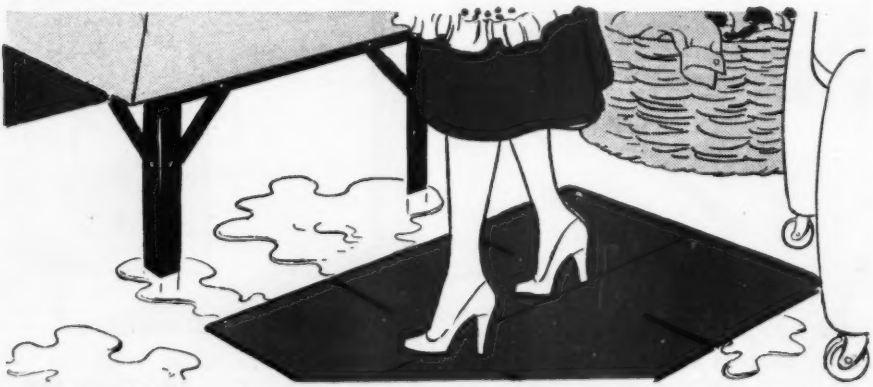


A POCKET MIRROR is an excellent memo pad for use near the telephone. Messages written on the mirror with a wax china-marking pencil can be wiped off with a wet cloth.

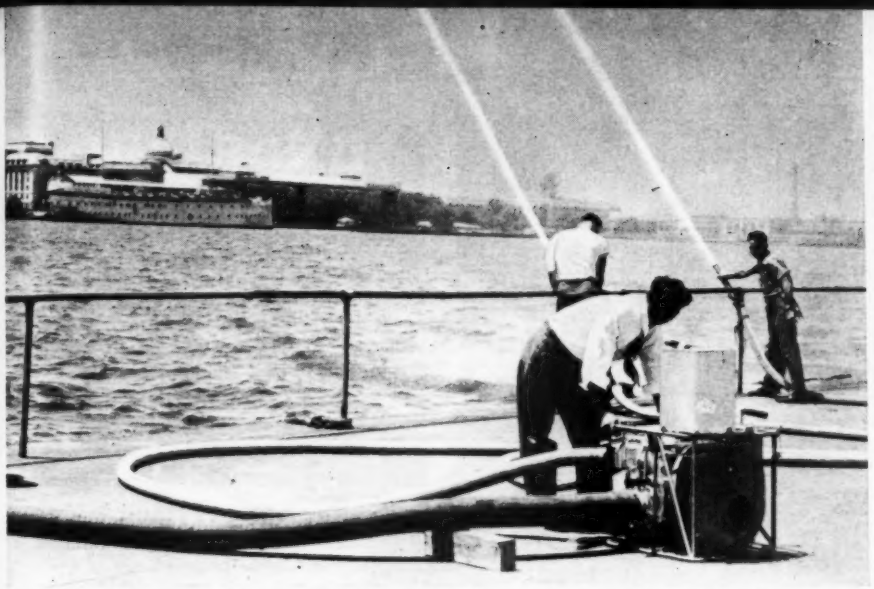
FABRICS WILL RAVEL LESS when cut for buttonholes if each place where an opening is to be cut is first marked with colorless nail polish. When polish dries, slits are cut.



A CANE WON'T SLIP ON ICY SIDEWALKS if a pop-bottle cap is screwed to its tip. The cap can be covered with a rubber crutch tip when the cane is used indoors.



A LEFTOVER ROOFING strip, rough side up, makes a good slipproof mat for use in front of laundry tubs or other wet places. It also acts as an insulator.



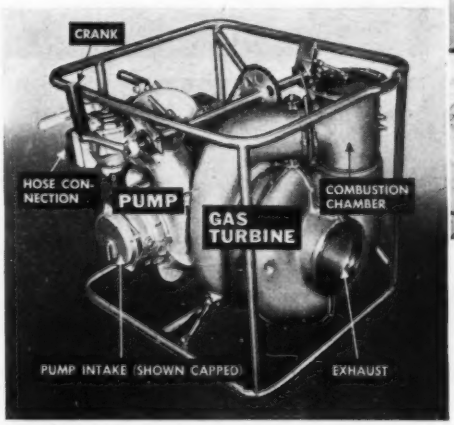
In trials, midget gas-turbine pump delivers 500 gallons of water a minute through two hoses.

Baby Gas Turbine Runs Pump

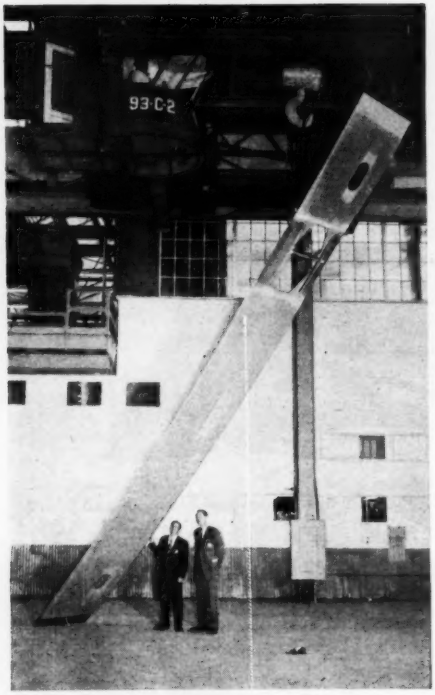
The smallest gas turbine ever built—you start it with a hand crank—is shown here driving a new fire-fighting pump aboard a Navy ship. The unit delivers 500 gallons a minute, yet is light enough for two men to carry, occupies two square feet, and weighs 165 pounds.

The midget turbines, which develop 45 horsepower and whirl at 40,000 r.p.m., will also be harnessed to airborne generator sets by the Air Force. Solar Aircraft Co., San Diego, Calif., is the designer.

TWO HAND CRANKS spin turbine at 11,000 to 12,000 r.p.m. Then its own power takes over. It has two seven-gallon fuel tanks, one of which is shown installed above.



PICTORIAL DIAGRAM shows main parts. Crank handles spin turbine through chain-and-sprocket drive. Overrunning clutch stops turbine from driving cranks.



Propeller Adjusts Itself

THIS new wooden propeller automatically changes pitch as the plane climbs or cruises. Inserts with diagonal grain make the Flex-O-Prop twist the right way for a better bite under each load.

Big Pieces Make Plane Wing

LARGEST ever cut from a solid slab, a 32-foot aluminum wing section (left) for a Super Constellation saves the weight and labor of joining 1,500 parts with 5,000 rivets.

Car Trailer Has Two Stories

YOU can ride upstairs or downstairs in the two-story trailer below, recently exhibited at a motor show in London, England. The lower level has a living room (right) with a fireplace, bedrooms, kitchen and bathroom. A flight of stairs leads to a double bedroom on the upper level. Almost a real "house on wheels," the trailer can accommodate five passengers, or seven if the living room doubles as a bedroom.

How Jackpots Are Hit in Suggestion Boxes

Millions of dollars are being paid off by suggestion boxes. Take a tip from these winners and try your luck.

By Philip Gustafson

IF YOU have the knack for dreaming up new gadgets—plus a secret desire to get rich quick—it is about time you took a hard look at the suggestion business. Most progressive business or government organizations have suggestion systems these days, and the chances are yours does too. If your idea clicks even faintly, it may bring you at least an "honorary" award of from five to 10 dollars. And if it's hot—well, the sky's the limit!

Charles Zamiska, of the Cleveland Graphite Bronze Co., shot at the moon. He worked out a better way of doing his own job—handling bronze castings. So far it has brought him in $28,000, and it's still paying dividends.

Johnson & Johnson, the surgical supply house, handed out $10,440 to Harry Kenny and Milton Combs for suggesting a method

'Dear Boss: Drop Dead'

THE rejects from some of the suggestion systems would make a good comic book. They range from friendly—and sometimes not so friendly—samples of the employees' wit to flights of imagination that would make a Rube Goldberg invention look like a primitive lever and fulcrum.

One caustic comment demands: "Make the company calendar smaller. Think I live in a barn?"

A wistful suggestion from another employee was dreamed up to eliminate tardiness: "Last man in blows the whistle."

Few suggestion boxes escape the character who takes his pen in hand to louse up a good suggestion blank with that highly original witticism: "Drop dead."

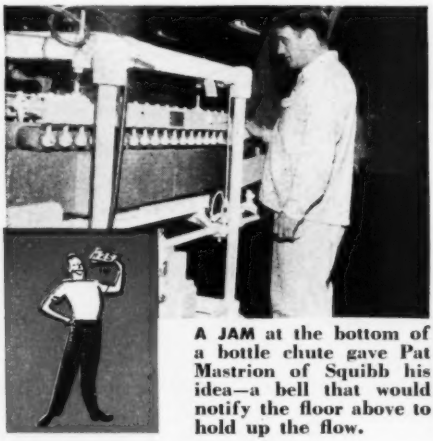
of saving material in the cutting of gauze pads. Swift & Co. paid Harold Deering and Cliff Fredericks of St. Louis $8,750 for developing a method of producing and marketing a new pre-packaged loin steak. Bausch & Lomb recently presented two profiling-machine operators, Charles McGill and Neil Bernard, with $5,230 for simply proposing that plastic stock be cut into narrower strips in the making of eyeglasses frames. Mrs. Nina Vincent, a grandmother working at Johnson & Johnson, won $2,600 for tipping the company off that plaster of Paris could be wrapped in one long piece of paper instead of two short ones.

Thirty-two-year-old Ken Keich had tossed a lot of ideas into American Cyanamid's suggestion box and collected on nine of them—a $10 check each time, enough for dinner and a night out with his wife and a sitter for their two-year-old. But when he was called in to pick up his tenth check, someone whispered, "You've just won $3,380." His hand shook so violently that he couldn't open the envelope, and the man next in line had to do it. What was Ken Keich's $3,380 winner? He told the company to keep a steam valve turned off for 30 minutes during one of its processes.

Health Dept. Employees Win Award

You need not pull a rabbit out of a hat to win a merit award—just leave him right in his cage. Dorothy Hoy and Mary Stang won a $100 award at the New York State Health Department Laboratory in Albany for devising a portable stanchion that can be easily attached to the door of a rabbit cage—to hold the struggling animals firmly while they are inoculated for the production of whooping-cough serum. This new gadget saves lugging a struggling 10-pound animal to a table and wrestling it into submission.

Hobbies often produce money-making contraptions. John Polk, a home-workshop enthusiast and chemist for the New York State Division of Standards and Purchase, won $100 by building—out of an old alarm clock, typewriter parts and assorted junk—a



A JAM at the bottom of a bottle chute gave Pat Mastrion of Squibb his idea—a bell that would notify the floor above to hold up the flow.

SOIL for farm and greenhouse at a N. Y. State Hospital is now steam-sterilized by these pierced pipes suggested by head farmer Ellis K. Busk.

RABBIT gets the idea of this stanchion suggested by Mrs. Dorothy Hoy and Mrs. Mary Stang to hold him still during inoculations at N. Y. health lab.

H. H. DUCKETT'S time-saving way to replace a jet-engine bearing sounded like a money-saving idea to GM's Allison Division suggestion committee.

device for measuring the slipperiness of various kinds of floor wax.

Outsiders Also Collect

Even outsiders cash in on their ideas. Thirteen-year-old Ronald Wheeler of Ilion, N.Y., recently went to the jet engineers of the Air Force and General Electric with an idea for a "dual afterburner" for increasing jet power. It so impressed the engineers that they flew him in an Air Force plane to GE's Lockheed, Ohio, jet plant to see how the engines are made. Now they're trying to work out a scholarship plan so Ronald can develop his budding genius.

Millions of ideas are brought out of hiding each year by suggestion systems to make life more convenient and livable for all of us. You never can tell *where* one is going to show up. The recent record-breaking flight of a Pan-American World Airways Clipper from New York to London in nine hours, 21 minutes was made possible by a suggestion submitted by meteorologist Lyle E. Brosche of Bayside, N. Y.

He suggested a new system of flight forecast based on the premise that the shortest route is often attained by flying in a sweeping curve and utilizing tail winds. Now this method is often credited with saving an hour or more in a trans-Atlantic flight. Brosche won $500 from the company and $250 from the Air Transport Association.

[Continued on page 234]

A $1,950 JACKPOT went to Morton Gorman, a Westinghouse machine operator at South Philadelphia. Because of his suggestion, four jet-engine flanges, instead of three, are made from same piece of stock in same operation.

FINISHED JOB, built with new precast wall units, has six rooms and attached garage. This home, near Greenwich, Conn., was built on concrete slab, but units can be used in houses with basements just as easily.

Precast Walls Go Up in a Day

Ready-to-bolt slabs for concrete house rise nearly as fast as a circus tent.

By Denis Sneigr

CONCRETE slabs bolted together to form walls are cutting construction time and costs for home buyers.

With the new sections, all exterior and interior walls of a six-room house can be put up in one day by six unskilled workmen and a foreman. On one job, all the interior and exterior walls for a 4½-room home were erected in 4½ hours.

This time saving means dollar savings to

CALKING COMPOUND ON EDGES insures tight joints. Spaces between uprights on inside faces are just wide enough for insulation batts.

THIS 200-LB. WALL SLAB can be handled easily by four men. It measures four by eight feet. Half units are two by eight feet.

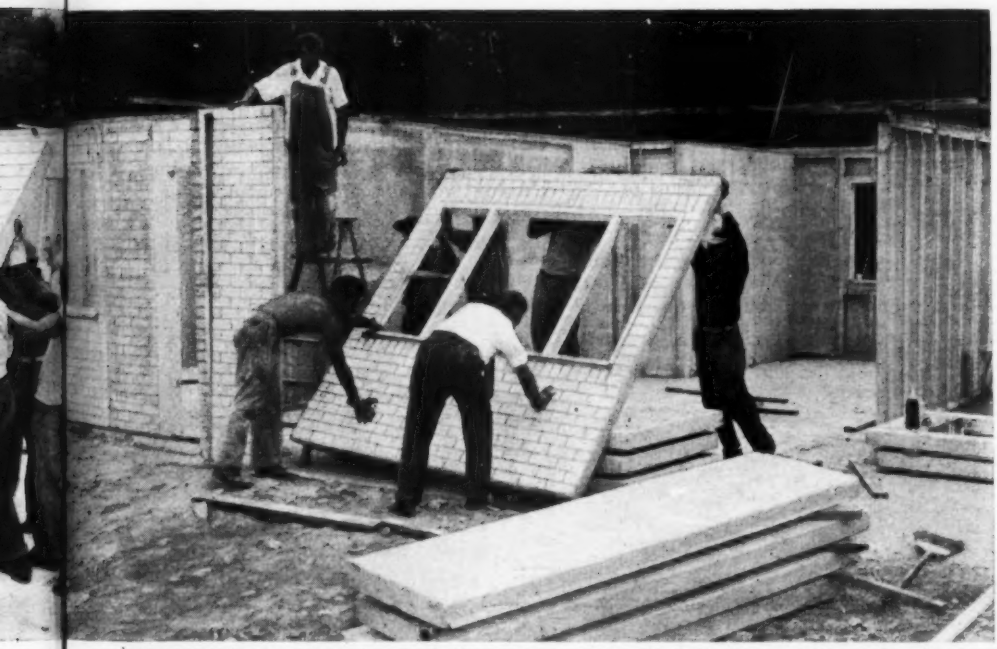
BOLTS THROUGH EDGES tie each wall section to the next one (left above). Bottoms are anchored by lag screws into wooden sleepers cast in concrete slab. Common wire nails can be hammered into the walls. Plates can be nailed or bolted to top of the walls.

the buyer. Gelbman, Inc., of Yonkers, N. Y., maker of the units, says the saving will be about 20 percent over conventional construction when the units are in mass production. Right now, the difference is about 15 percent.

The units are cast of lightweight aggregate, reinforced with quarter-inch rods and wire mesh. They are one inch thick, except on the edges and along the two vertical members, where the thickness is four inches. They are cast and seasoned at the company's Bronx, N. Y., plant.

Three exterior wall finishes are available—stucco and simulated brick or stone veneer. Interior wall panels are delivered to the job with the scratch coat already on them. They need only two more coats of plaster to make a finished interior wall.

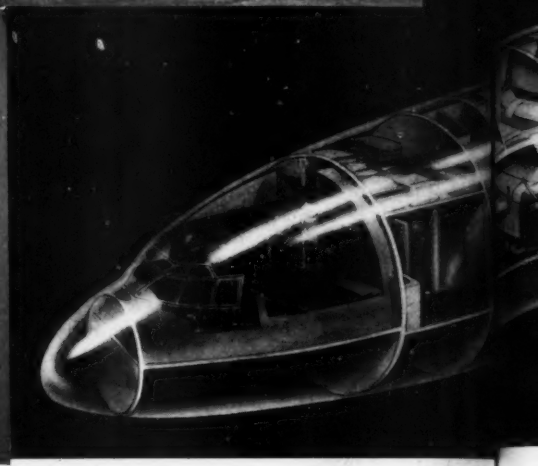
The units are so compact all the panels for a six-room home can be hauled to the job on one truck. END



PICTURE-WINDOW PANEL is raised. Carpenter (on ladder) waits to nail down plate. Panels are available with openings for three sizes of standard windows and doors. Panels come with door and window bucks cast in openings, ready for finish framing.

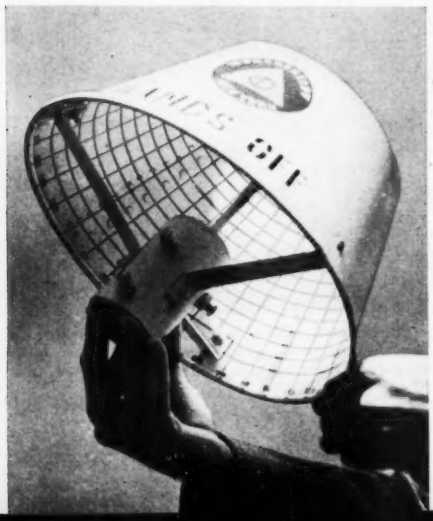
Biggest Airliner to Show Movies

LANDING at London Airport (above) is the world's biggest civil landplane—the 177-foot Bristol Brabazon I. Built to carry 100 passengers and a crew of twelve, the giant British airliner is now being used as a flying laboratory to develop an improved Brabazon II—whose luxurious accommodations (right) will even include a moving-picture theater. Powered by four coupled pairs of gas turbines, the Brabazon II is expected to provide nonstop service between London and New York by 1953.



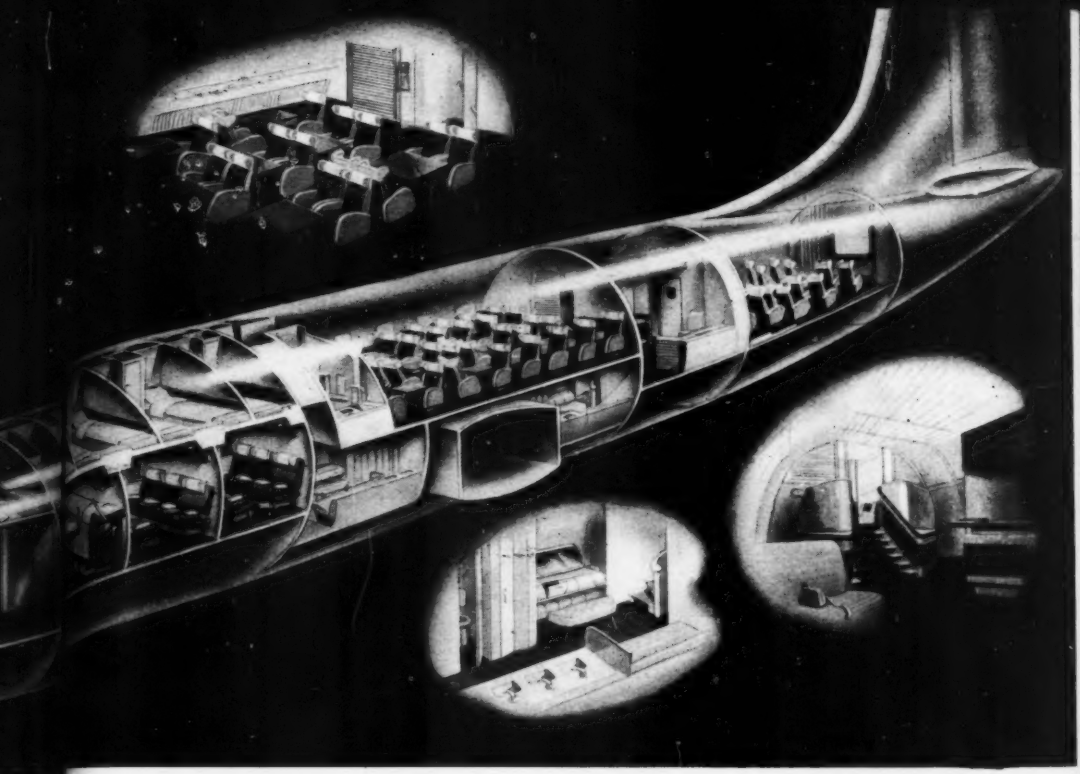
"Shade" to Aid Atom Defense

HEAT radiation from an A-bomb blast would scorch the inside of the painted metal "lampshade" shown below except where shadows were cast by the brass center rod and "shade's" upper rim. By means of lettered and numbered grid lines, these unscorched areas would show direction of blast. With data recorded by two or more such devices, height and center of blast could be quickly plotted for rescue crews.



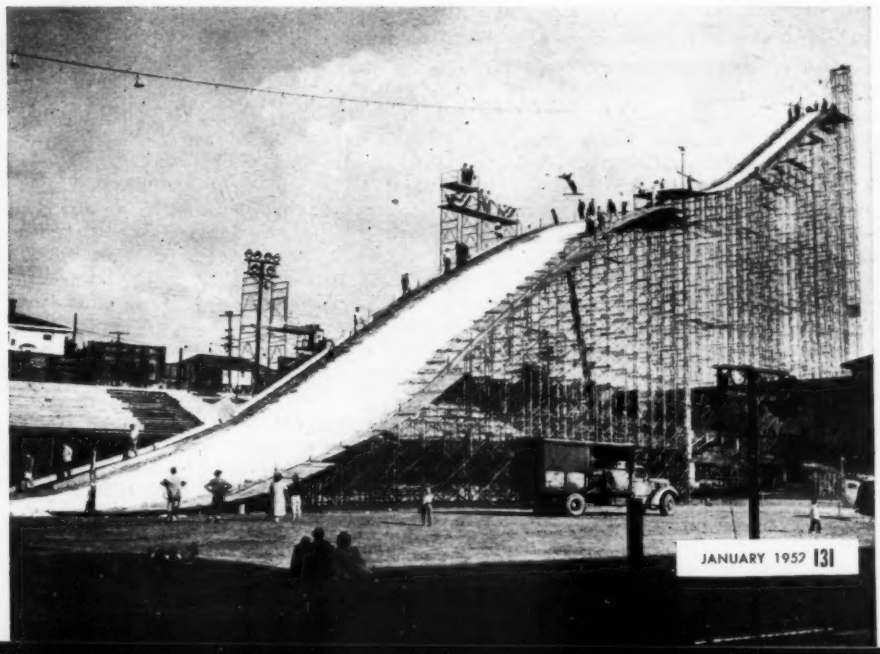
Armor to Protect Troops

GI BELOW is modeling a new plastic helmet and lightweight armored clothing developed to stop shell fragments and bullets. Under an outer vest he wears a nylon liner. The leg protectors are glass-fiber cloth.



Steel Ski Jump Brings Winter Sport to City Fans

THE 155-foot-high ski jump below was made of 1,200 steel frames of the scaffold type used in building construction. A wooden runway was covered with straw and sprayed with 40 to 50 tons of "snow" produced by ice-crushing machines. The slide was built for the Portland, Ore., Rose Festival last summer. Some enthusiastic jumpers ran out of snow and took landing spills in straw extending beyond the slide.



How Asphalt Tile Is Made

This popular flooring now comes in bright colors because it isn't really made from asphalt any more.

DESPITE its name, there is no asphalt in the asphalt tile shown above and, on the facing page, being made at the Brooklyn plant of Kentile, one of the world's largest manufacturers of this tough, colorful and popular floor covering.

The misnomer goes back to World War I, when many factory floors and ship decks were covered with a mastic made of asbestos fibers bound together with asphalt. This was mixed with a solvent to make a sticky paste. Six or seven layers were applied with a trowel—and each layer had to be allowed to dry.

An improvement came when the solvent was eliminated, and the asphalt and asbestos were rolled into sheets that could be laid down and walked on immediately. Asphalt was still the flaw, however, since it is black. Even when a little was used, in an effort to produce light colors, only muddy browns and tans resulted.

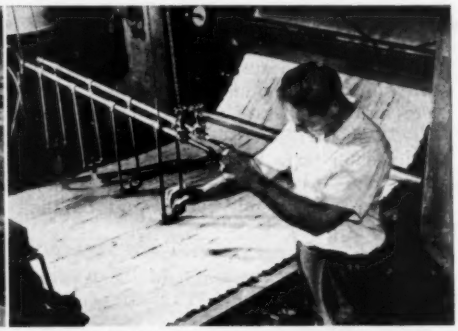
Then, around 1930, asphalt was replaced as a binder by light-colored synthetic resins, making possible the brightly hued floor coverings you see in homes all over the country. Some manufacturers still use asphalt, however, for dark-colored tiles.

Since then the industry has been booming. This year it expects to turn out some 640,000,000 square feet—enough asphalt tile to cover all of Manhattan Island.

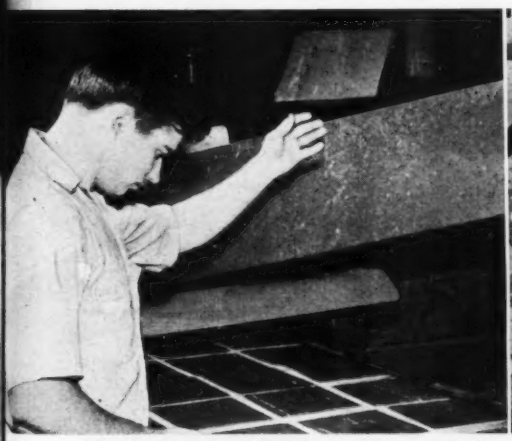
1 THIS DOUGHY MASS coming out of a Banbury mixer and dropping onto a conveyor belt is the raw beginning of asphalt tile. The ingredients, now thoroughly mixed, are a blend of asbestos, pitches, synthetic resins, pigments and limestone filler.

2 MARBLEIZING begins at the sheeting mill. Here an operator adds pigment chips (a modified tile mix) to doughy mass that came out of the Banbury. When it is now fed between rollers, the chips are distributed throughout. Plain-colored tile is also made.

3 OUT OF THE SHEETING MILL comes a caramel-like "blanket," about three-quarters of an inch thick, that has absorbed the pigment chips. Here gloved workers transfer hot blanket to conveyor going to calendering machines, which will make it thinner.



4 THE SHEET, after going through a calendering operation, has been reduced to either of two thicknesses—1/8 inch or 3/16 inch. Here an operator is adjusting wax sprays. The sheet also passes under cooling sprays and polishing buffer.



5 A CUTTING MACHINE, using special dies made by Kentile, makes several nine-inch squares at one cut. Inspector watches for imperfect tiles, which are sent back to the Banbury mixer. Refrigerated steel belt further cools tile on way to packing department.

6 CUSTOM-MADE TILES carry out any design a customer wants. Here craftsman is forming a camellia of many cut-out parts that will fit like a jigsaw puzzle into molds cut into a four-tile background. Special lamp keeps tiles pliable as he works. END

4-Deck Parking Lot Uses Drawbridges

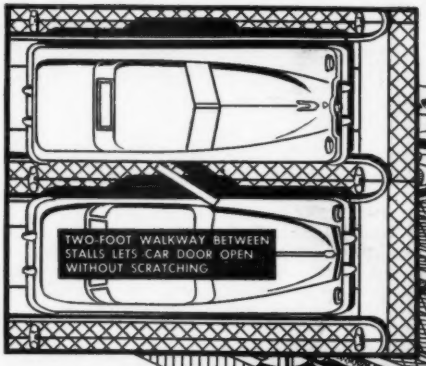
A FOUR-LAYER parking lot is helping to relieve traffic jams in Beverly Hills, Calif. Put up on a lot that used to hold 100 cars, it accommodates 450.

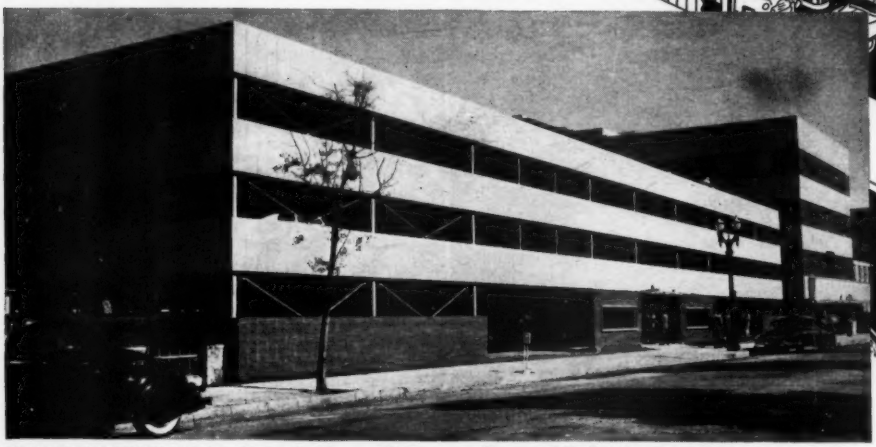
The new garage is made of light-gauge steel decks supported by slender steel columns. Prefabricated sections in a few standard shapes and sizes were assembled like scaffolding by workmen whose only tools were air wrenches. The whole thing was bolted together in 15 days. If the lot is needed later for a permanent building, the garage can be taken down and reassembled somewhere else. Only loss would be the foundation piers.

To save space, ramps between floors work like drawbridges, lifting out of the way of traffic on the floor below. Thanks to counterweights, they are raised and lowered by small ½-horsepower motors—instead of the heavy machinery that elevators would require.

The unusual structure, serving the Beverly Hills Medical Center, was designed by Ellis E. White, an aeronautical engineer, and built by the Multi-Deck Corp. of America.

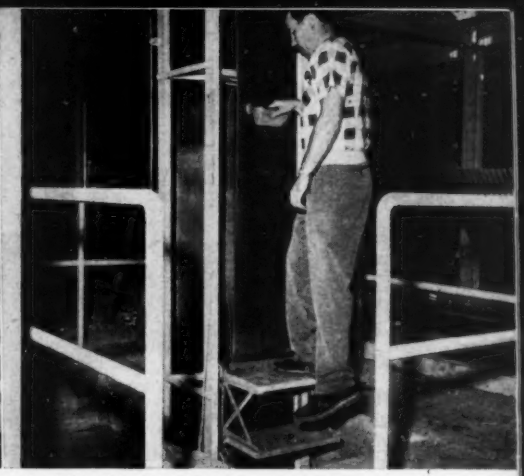
CARS ARE "FUNNELED" into narrow trackways of ramps and parking stalls by converging curbs. Rollers let wheels slip sideways.



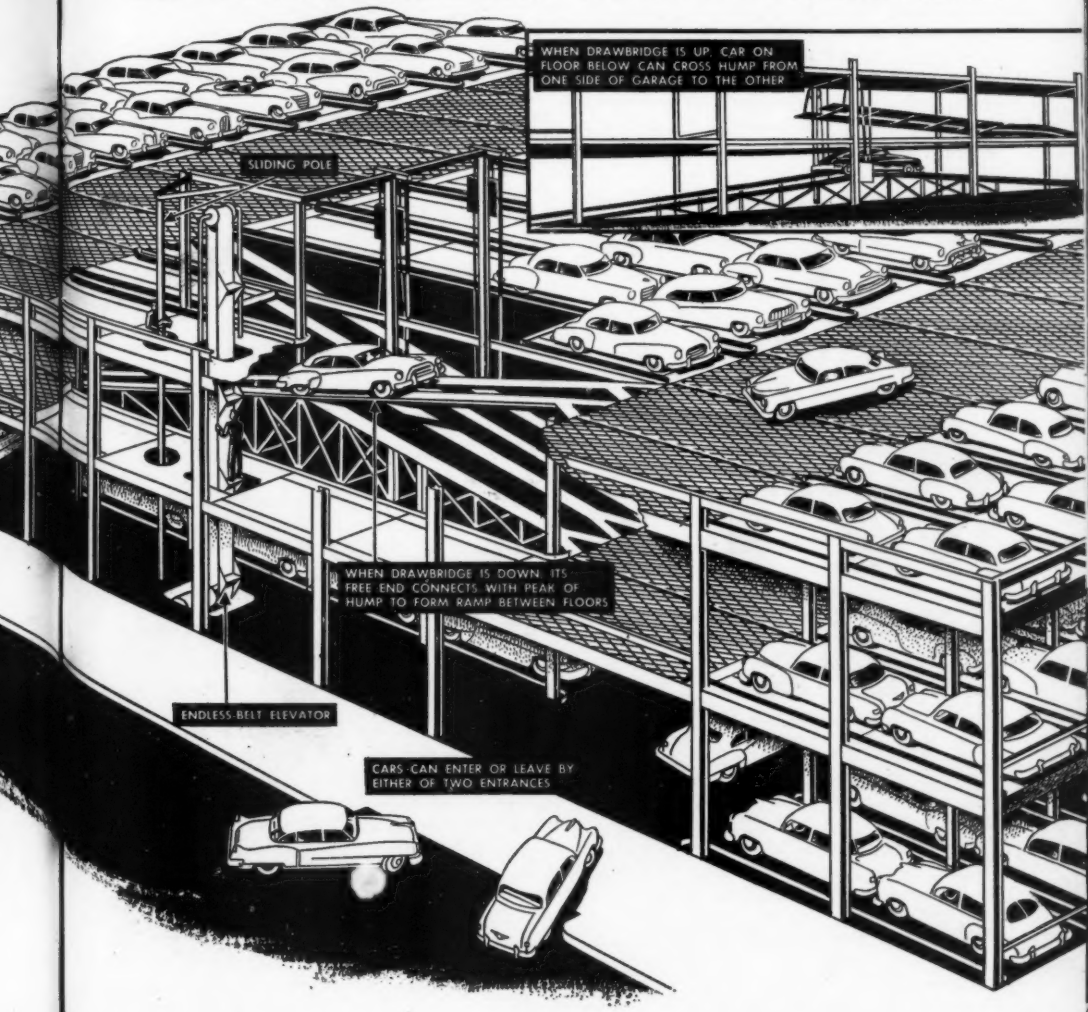


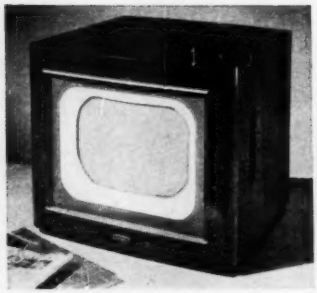
FOUR-FLOOR GARAGE is about half as tall as four-story building at right. Even when all stalls are filled, it's never necessary to move more than one car to get another out.

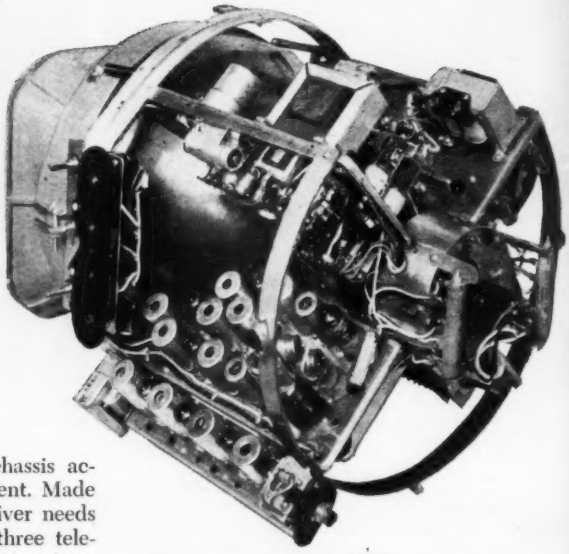
PUSH BUTTONS, operated by attendant from car, lower ramp to connect floors or raise it to let him drive across bridge on same floor.



ENDLESS-BELT ELEVATOR carries attendants up and down. Ground floor to roof takes 15 seconds. One minute later, customer gets car.







British TV Set Built Around Picture Tube

A CIRCULAR frame wraps the chassis around the picture tube of this unusual British TV set. Rotating the frame makes each of the four "paddle-wheel" subchassis accessible for servicing or replacement. Made by Murphy Radio Ltd., the receiver needs no channel selector, as Britain's three television areas have but one station apiece. Replacing the RF subchassis "tunes" the set for a different area.

ENCIRCLING PICTURE TUBE in new British TV set are four subchassis, each readily accessible for service. Smaller view shows exterior.

"Gun" Fires Rocket Missile

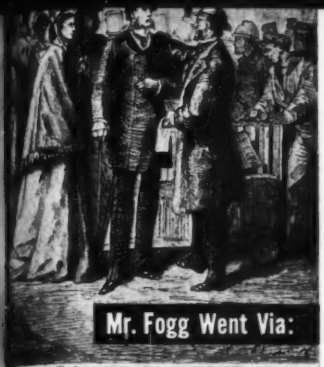
To BRING down a high-flying enemy plane, the 16-foot rocket above is fired from a launcher that elevates and traverses like an antiaircraft gun. A nearby trailer steers the guided missile to its target by radar. The famous Swiss armament firm, Oerlikon, has designed and exhibited the system.

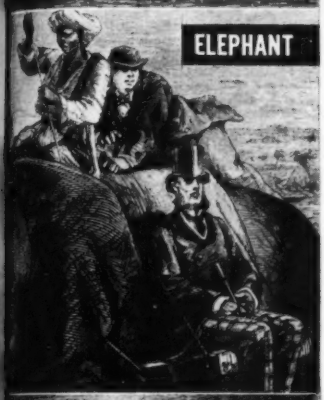
Light Bottles Won't Break

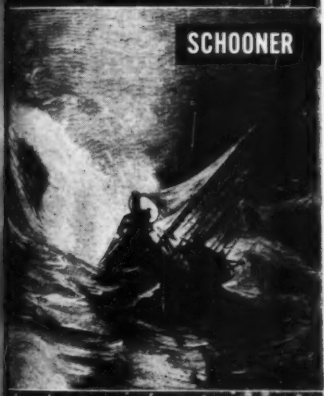
LIGHT enough to balance in a child's hand, smashproof one- and two-gallon bottles of polyethylene plastic have been developed for shipping corrosive liquids. They can be dropped 45 feet on concrete without breaking, and flex without cracking if contents freeze. A limited supply of polyethylene restricts the present output of bottles by the Plax Corp., Hartford, Conn., to military use only.

Sulfur Bonanza to End Shortage

EXPLORING for oil at the tip of the Mississippi River delta in Louisiana, prospectors have struck the biggest deposit of sulfur found anywhere on earth in the last 20 years. To exploit the find, the Freeport Sulphur Co. will set up a sulfur mine expected to cost $10,000,000 to $15,000,000, and to begin operating in 1953. Experts believe the discovery will relieve a world-wide shortage of this raw material for making sulfuric acid, one of the most useful of chemicals.

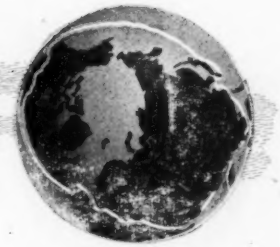






This is the 80th anniversary of Mr. Phileas Fogg's fast, fictitious trip around the world in 80 (or 81) days.

By Willy Ley



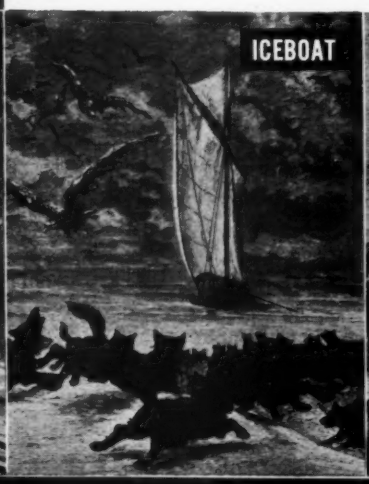
How the World Is Shrinking

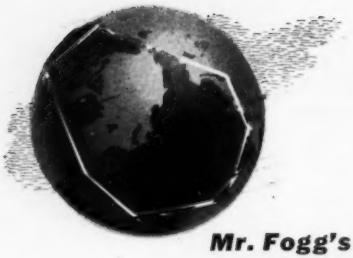
JUST 80 years ago, a novel appeared in Paris that caught the imagination of the public and has held it ever since. *Around the World in Eighty Days* was born of the same bubbling interest in science and technology that led to the birth of POPULAR SCIENCE that same year, 1872. Jules Verne's classic pitted man against time—and the race still goes on.

Remember the story? Phlegmatic Phileas Fogg bet $100,000 that he could go around the world in the then fantastic time of 80 days. He proposed to go 5,350 miles from London to Bombay via Suez in 20 days by rail and steamer; then 1,150 miles by rail to Calcutta in three days; 3,800 miles to Hong Kong by steamer in 13 days; 7,100 miles by ship to San Francisco via Yokohama in 28 days; 3,200 miles to New York in seven days; and 3,700 miles to London by steamer and rail in nine days.

But railways were found unfinished and steamers sailed ahead of schedule; an elephant had to be bought, Indians fought off. Fogg made it—but only because he gained a calendar day traveling across the international date line.

How fast could Mr. Fogg do it now? Turn the page and see.





Mr. Fogg's trip could be made in two days now.

PHILEAS FOGG'S imaginary record stood unbroken for 17 years—then people started smashing it and have kept on ever since. Today, of course, anyone who wants to get around our little planet in a hurry goes by air—and the present record actually totals fewer hours than Phileas took days.

But the late Bill Odom, who made the trip all by himself in 73 hours and five minutes in 1947, flew his converted A-26 bomber only 19,645 miles, considerably less than the full trip around at the equator.

The record for the full distance—or close to it—is held by the Lucky Lady II, an Air Force B-50 bomber that was the first plane to fly around the world without stopping. In 1949, the Lady flew eastward from Fort Worth to Fort Worth in three days, 22 hours and one minute, making an average speed of 249 miles an hour. To do this she was refueled in the air at four points along her 23,452-mile course—the Azores, Saudi Arabia, the Philippines and Hawaii.

Just this month, however, there's a plane going into service that—on the same basis—could cut the Lady's record in half. The new jet-propelled Comets that British Overseas Airways is putting on the England-India run have a 560-mile-an-hour top speed and cruise at 500. Their drawback is rapid fuel consumption, but if refueled repeatedly in the air a Comet could theoretically make the 24,000-mile circuit in just 48 hours.

Lanphier Holds Record

If like Mr. Fogg, however, you want to try to go around the world in commercial carriers, this nonstop technique will be of no help.

How long would it take you by regular air lines? Well, the record for circling the globe by scheduled commercial planes is four days, 23 hours and 47 minutes, set late in 1949 by Tom Lanphier of the Air Force Association. He covered 22,180 miles on a route very close to Fogg's—London, Syria, India, Hong Kong, Tokyo, San Francisco and back to New York. From New York to Hawaii, he traveled on Pan American Clippers, the rest of the way by United Air Lines and American Airlines.

Lanphier actually spent only 83 hours in the air: the rest of the time he waited on the

LUCKY LADY II, title holder for full round-the-world course, made trip nonstop. She was refueled four times, as shown above. The Air Force Superfort carried crew of 14.

ground. Since layover time has since increased instead of decreased it would be difficult for you to match Lanphier's time today. Pan American, for example, has increased the number of stops, so that flying around the world in its planes now takes at least five days, 22 hours. That's going via Manila. If you follow the Fogg-Lanphier route via Tokyo, the Pan-Am trip will take you a day and a half longer. The "excursion fare" for the complete Pan-Am trip, incidentally, is $1,700—$200 less in the off season.

Swapping from one line to another, you make about the same time—unless you're a VIP and can get them to hold planes for you where schedules miss connection. In that case you can make the trip in close to five days.

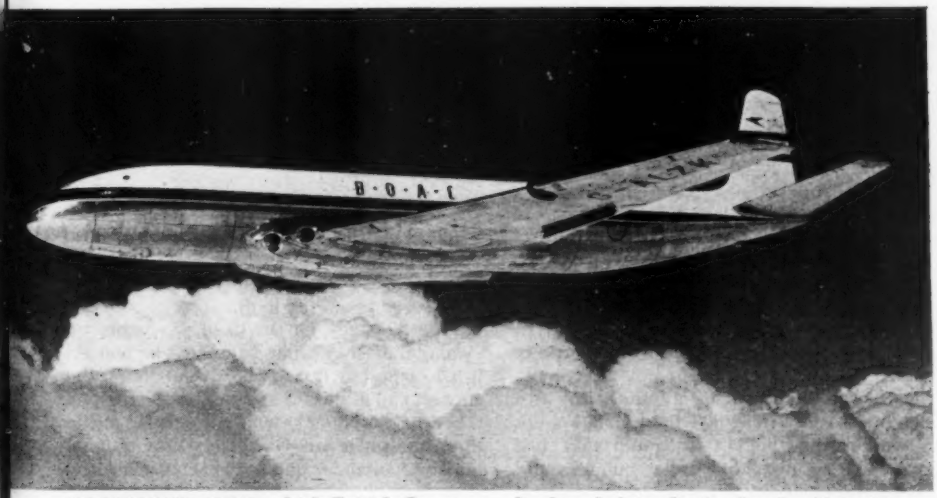
One Obstacle Still Exists

Air travel has shrunk the globe-circling time, but you still face one obstacle that also confronted Jules Verne's hero 80 years ago. In 1872 Fogg had to circle around through India instead of going across Russia because the trans-Siberian railway had not yet been built. Now you have to circle via India to avoid cracking your head against the Iron Curtain.

How fast will men go 80 years from now—in 2032? Turn the page and see.

FASTEST GLOBE-CIRCLING TRIP was made by Bill Odom in 1947, but he went 5,000 miles less than full equatorial distance. He spent 63 hours, 15 minutes in the air.

TOM LANPHIER HOLDS RECORD for trip by commercial carriers. Above, he checks in with customs at Delhi, India, where he was 16 minutes ahead of his schedule for that leg.



JET-PROPELLED COMET, which British Overseas Airways is putting into service between England and Asia, broke London-Karachi record by three hours, 10 minutes on trial run.

Mr. Fogg's trip will take only two hours in 2032.

WITHIN 80 years some people will be going around the world 12 times a day, every day in the year. Sound like a fantastic stunt? Not for these boys. Their nonstop globe girdling will be strictly in line of duty —manning a space station (PS, Oct. '51, p. 120) that will circle the world as endlessly as the moon.

The space station won't, of course, come into being all at once. An in-between step will be passenger-carrying rockets—in fact, plans now exist for such a rocket capable of completing the San Francisco-New York hop in an hour. Rockets will go into general service as we learn more about their design.

Speed Depends on Gravity

And from the information the rockets give us about the upper stratosphere and ionosphere will come data needed to design space stations. Just how fast these artificial satellites will "circumnavigate" the globe will depend on how far out in space they are. The station must go fast enough to make its centrifugal force balance the pull of gravity at its distance from the earth.

Since gravity decreases with distance, the farther the station is from the earth, the slower it will be able to go.

At the 350-mile level, it would have to move 4.7 miles a second to stay aloft, making the circuit trip in 96 minutes. But at a height of 1,037 miles it would go 4.4 miles a second and the circuit would take just two hours. And 22,300 miles out it would travel "only" about two miles a second and would need 24 hours to go around once.

The main purpose of a space station will be to serve as a refueling base for space craft on long voyages. On a trip to the moon, for example, most of a ship's fuel will be needed just to take off. But at the space station the captain can fill his tanks again. And when he takes off this time, he will not only be above the atmosphere and have less gravitational pull to overcome, but he will get a healthy start from the velocity of the station.

The station will be useful in other ways, too. Besides making a wonderful observatory

SPACE STATION will start as bicycle-wheel structure (inset) then be elaborated to mini-

ature satellite. Space ships will nose in to outer ring to refuel. Observatories, labs, fuel tanks, repair shops and living quarters will be housed in central sphere.

for study of both the earth and the heavens, it will be a better research lab than any on earth. You need a perfect vacuum for an experiment? Pick an outside room, put on a space suit and unscrew the window. You need extreme heat? Simply concentrate the sun's rays on your specimen with a parabolic mirror: it will soon be vaporized. Or you want to cool something down near absolute zero? Put it into the shadow of the station and keep it there.

Since there will be no apparent gravity on the station, biologists will be able to find out just how much gravity influences growth. Does an amoeba split in two because it has reached a certain state, or simply because it is getting too heavy?

And finally, the space station can serve as a short-wave and television transmitter doing the job of hundreds of ground relay stations. That application will save money—and may help to get the station built. END

Aids to Modern Living

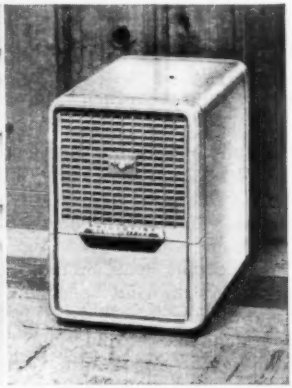
Cedar Paint. Now you can paint a cedar lining on closet walls. Water added to this pulverized cedar wood makes a moth-repelling liquid that can be brushed or sprayed. *Cedar-Lux Products Co., Kansas City, Mo.*

5-in-1 Drier. This clothes drier serves as a hamper between washdays. Raise the top, add a shield and it's a room heater or hair drier. Turn off heater and fan cools room. *Nat'l. Eng. & Mfg. Co., Kansas City, Mo.*

Nut Chopper. When the crank of the grinder below is turned, nut meats fed into the hopper fall through to the bowl in bits and pieces. *The Washburn Co., Worcester, Mass.*

Shade Mop. This Venetian-blind washer carries its own cleaning fluid in a built-in reservoir. It comes with a quart of liquid for refilling. *Nu-Designs Co., Kalamazoo, Mich.*

Room Drier. Damp basements can be kept comfortably dry with a dehumidifier that plugs into any 115-volt outlet. It also filters the air. *Frigidaire Division, Dayton, Ohio.*



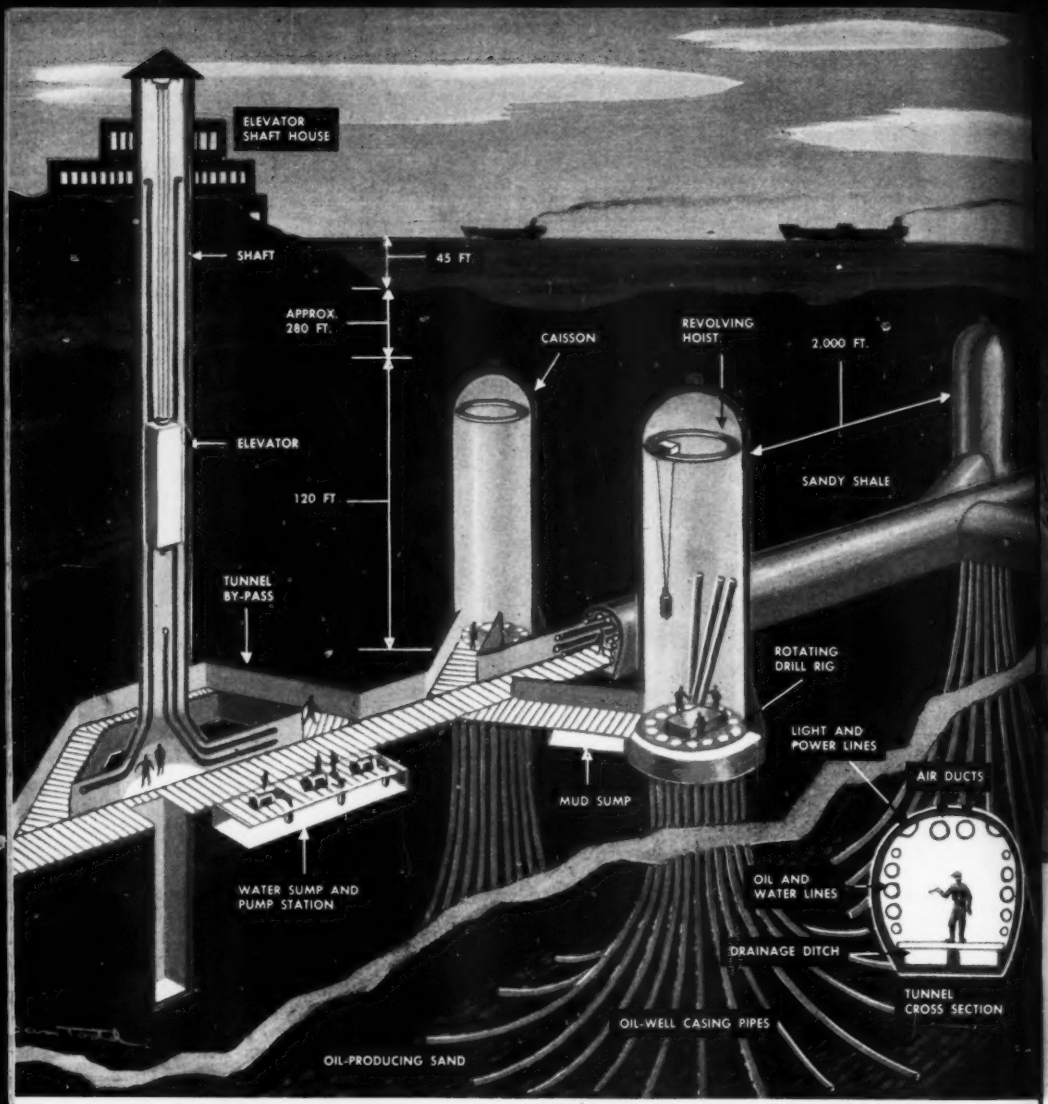
Washable Rugs. Reversible, nonskid rugs like the one shown here are made from interwoven plastic strips. They're said to resist scuffing, staining and tearing, and come in six sizes. *Susquehanna Mills, Inc., New York.*

No-Fog Mirror. If hot water from the shower steams up this medicine-cabinet mirror, just press a button. An electric heater behind the glass clears it and keeps it free of fog. *Charles Parker Co., Meriden, Conn.*

Thread Holder. A ball of knitting yarn or crochet thread unwinds smoothly without knots or snarls when mounted on the plastic turntable below. *O. L. Phillips Co., Rockford, Ill.*

Umbrella Light. A flashlight in this umbrella handle will light up puddles on stormy nights. A twist of the handle and a lock ring turns light on or off. *Ruth Cooper, N.Y.C.*

Self-Watering Pot. This plant needs watering only once a week. A wick carries water from the base of the pot to the plant roots by capillary action. *Quality Molding Co., Chicago.*



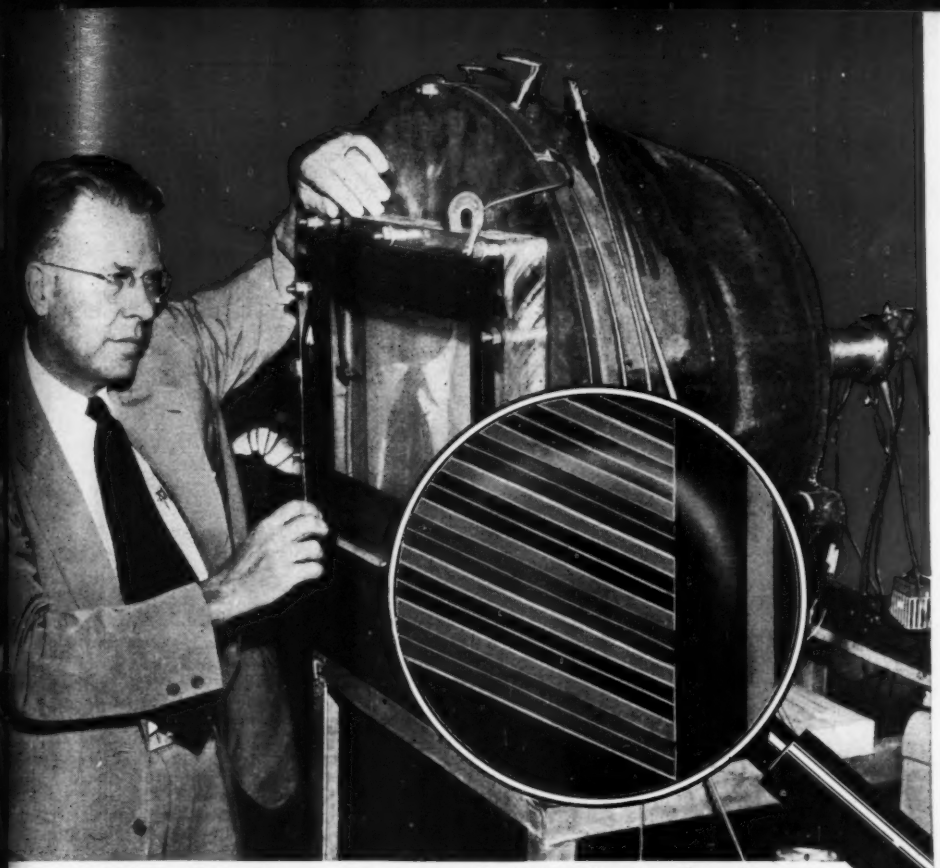
Tunnels to Tap Undersea Oil

HOW do you get at forty billion gallons of oil hundreds of feet below the sea without blocking a busy harbor?

That was the $100,000,000,000 question—the approximate value of oil under the ocean near Long Beach, Calif.—until engineer-geologist Hillman A. Hansen came up with the proposal shown above.

The plan envisions a vertical shaft on shore. From its bottom, a network of tunnels would be dug out under the water, about 400 feet below the sea bottom.

At the ends of the tunnels, caissons would be constructed to give working space, full-size drill rigs would be brought in, and the digging would start from there. A number of wells would be sunk from each caisson, fanning out in a circular pattern. By whip-stocking—slanting the drill—each well could be placed exactly where desired. Twenty wells from a caisson would serve 100 acres of the sub-sea oil field.



HOMEMADE MODEL of tricolor tube developed by Dr. Ernest O. Lawrence contains such unorthodox parts as spark plugs, pipe fittings and horseshoe magnets — but it works. Enlarged section shows how red, green and blue color phosphors are arranged in parallel lines on picture screen.

Scientist Invents Simple Color-TV Tube

Product of atom expert's home shop can work with any color-television system.

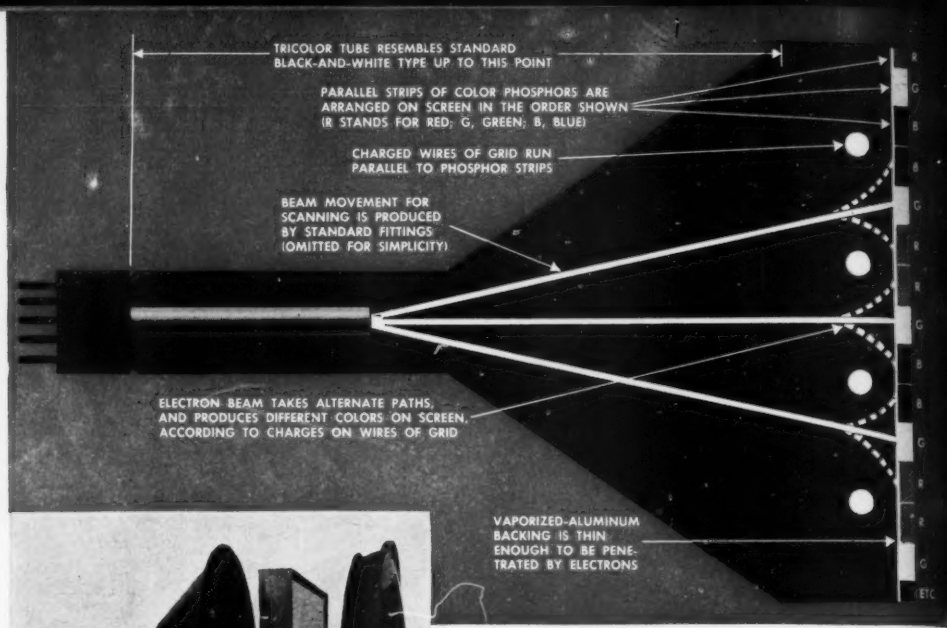
By Darrell Huff

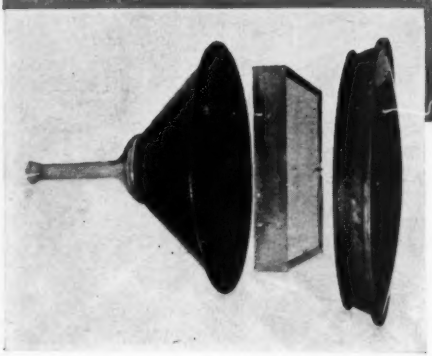
A HOME-WORKSHOP enthusiast of Diablo, Calif., has invented a new television tube that may help end the wrangle over color TV.

Working in his spare time, Dr. Ernest O. Lawrence—the man who invented the cyclotron and who now directs the University of California Radiation Laboratory—has come up with an all-purpose TV viewing tube simpler than others developed until now.

Tune in a color-TV program, and it gives tricolor pictures. It will work with any of the several color-TV systems proposed and with black-and-white television as well. And, say its sponsors, it can be mass-produced at a cost little greater than that of today's black-and-white tubes.

The thing began in a converted garage. Dr. Lawrence, who built the first atom-smashing cyclotron before he was 30, pro-





HOW IT WORKS. **Simplified diagram of Lawrence tube (above) shows path of beam through grid of charged wires to screen. Grid lets beam pass unaffected (solid line) or deflects it upward or downward (dotted lines) so that it strikes phosphor strip of desired color. Diagram exaggerates width of phosphor strips. Screens of experimental tubes actually had 400 green strips and 200 each (double-width) of red and blue. Photo (left) shows cone, grid-and-screen block, and glass cover of "pilot" commercial model.**

duces many ideas beyond those fitting into his work as an atomic scientist. To have a place to work them out in his spare time, he bought a small house an hour's drive from his Berkeley home, and turned the double garage into a hobby shop. He equipped it with lathe, drill press, tool grinder, horizontal mill, bandsaw, belt sander—and, electrons being his business, an oscilloscope and a signal generator.

Children's Questions Started It

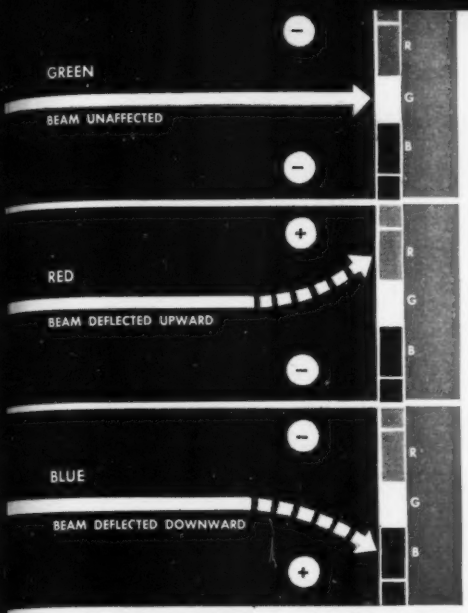
One thing that emerged from the home workshop was a device for sharpening television images. Then, stimulated by his children's questions—which inspired others of his own—he tackled the problems of color TV.

In a TV tube, an electron gun sprays a thin stream of electrons, like a beam from a searchlight. They are invisible, but they produce a glow when they strike phosphors forming the chemical coating of the viewing screen. The picture you see consists of luminous points, produced as the flickering beam moves rapidly across the plate in a straight line, then in another slightly below it, and so on. Color TV requires doing this in three stages—once each for red, green and blue. Your eye merges the images of each color into a complete natural-color picture.

Suppose, reasoned Dr. Lawrence, you start with a black-and-white tube. First, chop off the viewing end. In its place, put a grid of fine parallel wires that can be charged positively or negatively. Beyond the grid, mount a screen bearing strips of phosphors that glow in the three primary colors.

Now, if you charge two adjacent wires of the grid negatively, they will both repel the beam from the electron gun—because electrons are negative. The beam will go straight through, between the wires, and strike the phosphor that glows green.

If you charge one wire positively and the next one negatively, the beam will



GREEN, RED AND BLUE are produced by varying charges on grid wires as above. Negatively charged electrons of beam are repelled by a negative wire, attracted by a positive one.

be deflected toward the positive wire. It will strike the phosphor that glows red.

Finally, reversing the charges will deflect the beam to the blue phosphor.

This new way of selecting colors in a tricolor-TV tube looked good to Dr. Lawrence. To get from theory to practice, he stocked his workshop with new tools and equipment and tripled its area. Part-time workers were hired to speed the project.

The first crude model that Dr. Lawrence and associates put together bore little physical resemblance to a vacuum tube—a fact that will surprise no inventor or home mechanic.

Iron Works Made Body

From a pencil sketch on wrapping paper, an iron works made the body of the tube out of sheet iron. The front window was $50 worth of two-inch-thick Lucite plastic. Ordinary auto spark plugs served as high-voltage fittings. Horseshoe magnets, stuck on here and there, counteracted magnetism of the steel body set up during welding. Pipe fittings such as plumbers use connected a gauge to measure vacuum maintained by pumping. Color phosphors were standard ones printed on the viewing screen by the silk-screen process.

When the makeshift model was demonstrated to experts in New York City last September, they judged color quality excellent. Some thought the image a bit grainy—for which the remedy, Dr. Lawrence explained, is increasing the number of wires in the grid. He also made it plain that a manufactured version will look nothing like the bulky homemade tube.

During the early stages of Lawrence's work on his tube, an organization was created to turn it into a commercial product

[*Continued on page 252*]

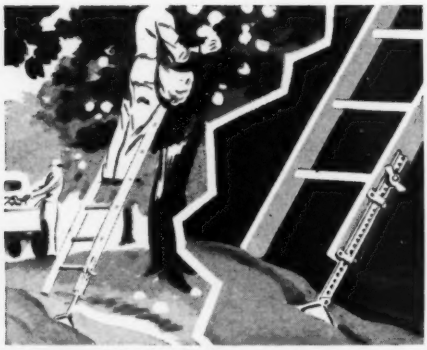
Tubes for Color Television? Here Are Five Other Kinds

THE MANY AVENUES to color TV now being explored are indicated by this RCA exhibit of five different experimental tricolor tubes. In rear row are "three-gun shadow-mask" tube used in RCA field tests (left) and "line-screen" tube; in front row (left to right) are "grid-controlled," "one-gun shadow-mask" and "45-degree reflection" tubes.

I'd like to see them make...

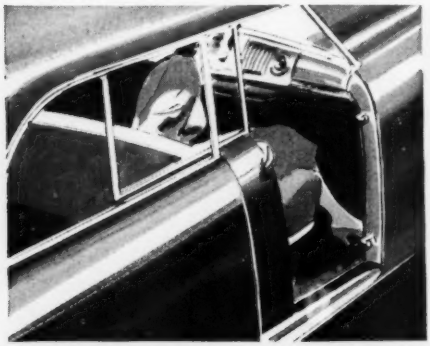
Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

TRIANGULAR TELEVISION AND RADIO CABINETS to fit in corners. Since sets are often placed there anyway, this would afford better furniture arrangement and, with TV, better viewing.—*Stephen Matovich, Portsmouth, Va.*



A LADDER WITH ONE ADJUSTABLE LEG so that it would stand level on uneven ground—for picking fruit, etc. Leg could be adjusted by means of a metal extension and thumbscrew. —*Warren Shepard, Syracuse, N. Y.*

AN AUTOMATIC CLOTHESLINE REWIND with a locking spring. With it, the line could be stored out of the way yet wouldn't sag when pulled out and fastened to another post for use.—*Maude Anderson, Media, Pa.*



AUTOMOBILE DOORS WHICH WOULD SLIDE BACK instead of swinging out—to eliminate the hazard of a door's opening when car is in motion, and to save space when getting in and out of car.—*D. Hoffman, Pelham, N. Y.*

AN EXTRA, FALSE SCREW TOP on an auto-polish can. You could screw the lid on the extra top when using the polish and thus avoid the annoyance of losing or misplacing it.—*Dave Vonderahe, Torrance, Calif.*

Derrick Jumps into Action

BUILT to install heavy pumps and lift as much as 50 tons, this odd-looking portable derrick arrives at a job collapsed (above) but is quickly ready for work. The operator, seated behind the cab of the truck, flips it on its feet by means of a powerful hydraulic ram. The derrick's free leg swings to the ground, where it must be supported by jacks when the winch-controlled sheave tackle hooks onto a big load.

Plywood Makes Light Trailer

AS STRONG as steel, so its builders say, the new refrigerator truck-trailer above uses little of it. Instead the vehicle is made almost entirely of plastic-laminated plywood, molded in one piece, by Chicago's Pressed Steel Car Co. It is said to be lighter, roomier, better insulated, easier to maneuver, and rustless.

Robot Drills Oil Wells

STEEL hands and arms moved by compressed air and water may take oil drilling entirely out of human hands. With new equipment made by Byron Jackson Co., Los Angeles, a man at a panel controls power tongs (upper left) that hold and spin bit and pipe in and out of the hole. Derrickman stacks pipe, also with levers.

Loggers Invade African Jungle

Modern machines are bringing out rare, heavy, durable wood.

RARE African woods are not quite so rare any more. Thanks to Marshall Plan dollars, large untapped forests in the French Cameroons on the west coast of Africa are now being developed.

Logging these valuable woods used to be difficult and slow because only primitive native labor was available for working in the dense jungle undergrowth, and there were few roads. Rivers could not be used for transporting, either: this wood is so heavy it will not float. Shortly after World War II, however, American bulldozers began to fight their way through the thick vegetation to clear roads for dragging out the timber. Up-to-date sawmills were also erected.

Now 60 varieties of tropical woods are coming from Africa. One of the most useful is azobe, which comes from the Bongossi tree. A tough, durable hardwood, it weighs 60 to 70 pounds per cubic foot when seasoned. Because it resists decay it is used mainly to make underwater piling, bridges and railroad ties.

Photos on these pages show how rare-wood trees are cut down and processed by native lumberjacks and modern machines.

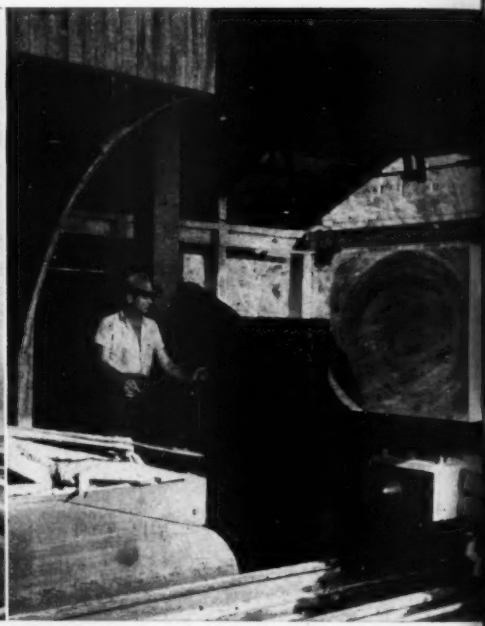
THIS MAMMOTH LOG, typical of the rare-wood timber growing in equatorial Africa, is thick-

er than the man standing on it is tall. Felled by natives and hauled out of dense forests by American tractors, logs like this often weigh as much as 33 tons apiece.

TWO TRACTORS, one dragging and another pushing, are needed to move big logs out of the jungle to a clearing. The log hangs from a hoist attached to the tractor in foreground.

THE LOG IS LIFTED BY HOISTS and loaded onto a special trailer truck. Called azobe, the wood is a tough, reddish-brown timber, used for making docks and railroad ties.

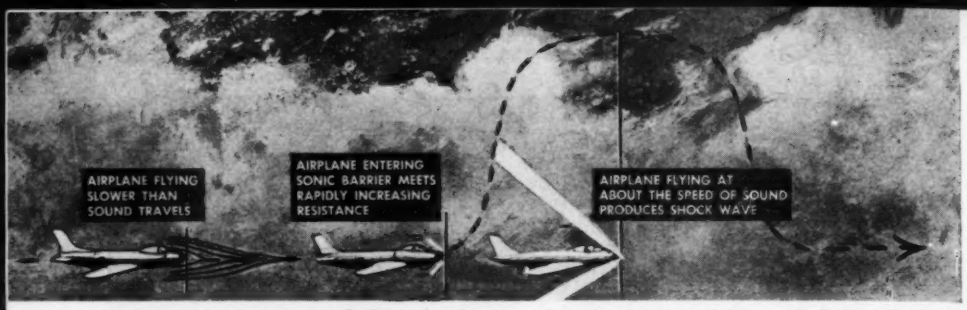
AFTER BEING CUT IN TWO SECTIONS, one part of the log is swung over the ramp onto a conveyor belt that takes it into the sawmill. Natives above guide log as a crane lowers it.



STRIPPED OF ITS BARK, the log moves through the bandsaw to be cut into lumber. The man at the controls is an American, Charlie Dean, who was sent to Eseka to instruct personnel.

DESIGNED FOR A TROPICAL CLIMATE, this sawmill in the town of Eseka has a wide roof to keep out the hot sun, and open sides for good ventilation. Steam-powered machinery, costing $68,000 per unit, has been installed in the building. The logs in the foreground above are waiting their turn to be carried up the ramp at the right of the building.

WHEN SAWED INTO BOARDS of specified size, the lumber is carried by fork-lift trucks to a nearby railway for shipment to the seacoast. In the photo above a fork lift raises a load of boards, dumping them on flatcars. The railway, one of two in French Cameroun, West Africa, runs to Douala, a port city 110 miles away.



SONIC BARRIER, encountered abruptly when a plane matches the speed of sound, is a sharp increase in air resistance. Only knotty mathematics can explain exactly why it occurs.

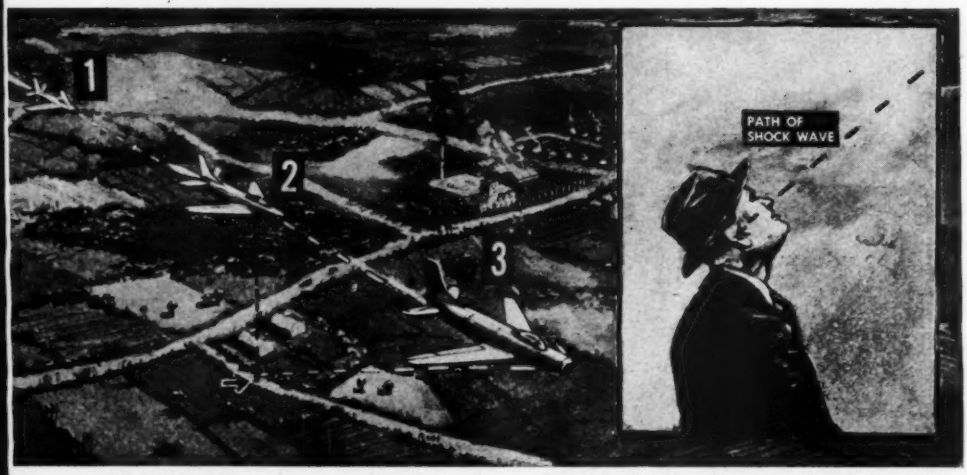
AT SUBSONIC SPEEDS, sound waves race ahead of an airplane in flight and disturb the air in its path, thus deflecting the air and increasing pressure comparatively slowly.

AT SUPERSONIC SPEEDS, sound waves lag behind. The airplane hits the air ahead with no warning, deflecting it and increasing its pressure violently, creating a shock wave.

Why Supersonic Planes Go Boom

YOU can't hear a plane that is traveling toward you faster than 700 miles an hour, which is just about the speed at which sound itself travels. But you know when it has shot past you, for you hear a sudden, sharp explosion, like the crack of a rifle fired nearby. What you actually hear is the delayed report of the plane's collision with the so-called sonic barrier, a kind of wall of air that suddenly builds up in the path of any object overtaking the speed of sound.

The public is gradually getting used to this startling noise as more and more planes —Sabre jets, for instance—smack through the sonic barrier.



YOU CAN'T HEAR a plane traveling faster than sound as it approaches (1) or when it's overhead (2) because the shock wave fans out behind (3), like the wake of a ship, striking your ears with sudden force and an explosive sound (right above) after plane has gone by.

Inside Button Opens Car Trunk

You need no key to unlock the luggage compartment of the new British four-door Velox sedan (above). Press a button beside the rear seat and it springs open (left), close the cover and it locks itself again. Made by Vauxhall Motors, Ltd., the six-passenger car has a six-cylinder engine of 2¼-liter (137-cubic-inch) displacement and sells in England for about $1,000.

Tiny Radar Steers Missile

SUCH marvels of electronics as a five-tube radar amplifier no larger than a cigarette package (right) help guide the guided missiles. They are used in weapons like the air-to-air, rocket-propelled Ryan Firebird (below). Like their huge counterparts on land and sea, the Tom Thumb radars bounce echoes off targets—and do it automatically, in the bargain.

How a Champ Drives a Truck

Here's his secret for dodging trouble while highballing some 36 tons of rolling weight at passenger-car speed.

By John H. Castner

Three-Time National Truck-Trailer Champion

as told to R. P. Stevenson

FOR the past 13 years, I have been driving the biggest thing on the road—a huge truck and trailer combination that hauls a payload of 19 tons or more.

My outfit is one of the world's largest highway freighters. You meet combinations of such size only in the extreme western states. In the East, weight and length limitations keep them off the road.

To equal the over-all length of the typical truck-trailer combination, you would need four medium-size passenger cars, bumper to bumper. From headlamps to trailer tail gate, these rigs span nearly 60 feet. Fully loaded, they weigh as much as 36 tons.

Driving such a highway heavyweight isn't a job for a boy. Looking for work, you can't walk in and say "I'll drive that one." Before you solo, you must learn a lot of ropes and convince your boss that he can trust you with the rolling wealth the rig represents.

My regular run is south out of Portland to Roseburg, Ore., about 200 miles one way, for the Pierce Auto Freight Lines of Portland. This means going down one night and coming back next morning after an eight-hour layover.

Driving the family car is a picnic compared to tooling a truck-and-trailer combination over the highway.

Climbing into the cab, you become all eyes. Through experience, shifting gears and other mechanical operations are automatic, a part of your reflexes. You can't really concentrate on what's ahead, behind and all around you until the mechanical part has become instinctive.

Drive Ahead of Yourself

Highballing down the highway, you drive ahead of yourself—just as far as you can see. You check side roads before you come to them. You keep an eye on the traffic ahead of and behind you. You glance frequently at the gauges on the instrument panel for telltale signs of impending trouble in the 200- or 300-horsepower Diesel that's rolling you on your way.

You drive relaxed—but always ready for an emergency. If you have personal worries, you put them aside—or try to at least. Many trucking companies now make a practice of

helping drivers through home-life difficulties, overdue mortgage payments, domestic wrangles and the like. They know the worried driver can't give full attention to his job.

Defensive Driving at Work

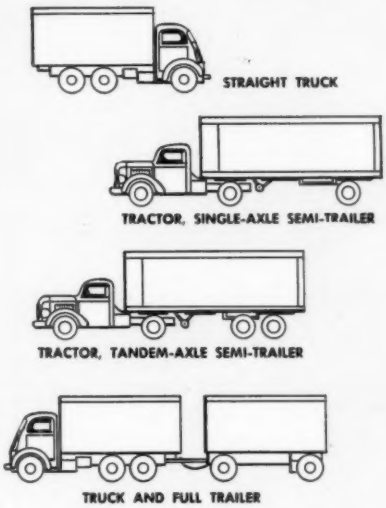
All this adds up to what truck drivers know as defensive driving. But that doesn't mean outguessing other drivers. Far from it. The safety department of the American Trucking Association defines defensive driving as "operating your own vehicle with such care that, no matter what other drivers do, you will be able to protect yourself and not become involved in accidents because of their mistakes."

Suppose you were coming to an intersection on a through highway in open country. Off to the right, you could see a car approaching on a side road you knew to be marked with a stop sign. You noticed the driver remove a hand from the wheel to emphasize a point in his conversation, perhaps turning toward the passenger. Suppose the car would reach the intersection at the same time you would.

That's where you should go into defensive driving. Any safety-minded truck driver would. Even though we think the car would stop, we wouldn't take chances.

As a sidelight on that, I have noticed that a woman driver, alone, is exceptionally good, a lot more conservative than a man. But if she has somebody with her, her mind is more apt to be taken away from the job of driving—by conversation, by turning to look at a shop window.

TYPES OF TRUCKS



On a run, a truck driver tries to maintain an even speed. But for safety, speed is always suited to road conditions. On a dry road, 50 or 60 may be okay, but on snow or ice 25 miles an hour may be too fast.

To qualify for a state or national truck roadeo, a driver *must* pay attention to details like these. An accident automatically bars him from the next roadeo. After he has driven for a year without an accident, he still doesn't get into the final field tests on truck inspection and driving until he has

THREE-TIME CHAMPION John A. Castner is shown here with other winners of the 1951 National Truck Roadeo. Left to right, they are Albert Pomahatch, St. Paul, a tractor and single-axle trailer driver; Alex Adamski, Chicago, tractor and tandem-axle trailer driver; Mr. Castner; and James E. Tucker, Charlotte, N. C., straight truck driver. Mr. Castner, who also won the roadeo championship in 1949 and 1950, was picked as the trucking industry's driver of the year, too, in 1950. He has driven a truck for 13 years now without an accident.

WINNING COMBINATION. Here's the giant truck and full trailer combination that John H. Castner, author of this article, drove in winning his third national title in the 1951 truck roadeo at Chicago. The combo is nearly 60 feet long. The four class winners at the roadeo each year become top men among nearly eight million truck drivers in U. S.

proved his knowledge of safe driving, the trucking industry, first aid and fire fighting. Personal appearance counts too.

Whether you are driving a truck or a car, I think one of the most important safety rules is keeping to the extreme right of the highway. This makes it possible for a person behind to see around without crossing the center line. And on a curve, keeping to the right may give just the margin needed

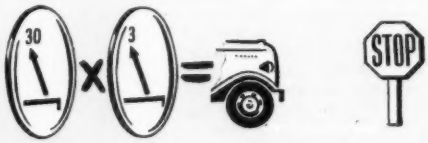
Truckers Use These Formulas for Safe Driving

HOW quickly can you stop? Next time you are on the road, test yourself with these two formulas. Truck drivers have found them right on the nose.

When an emergency looms, it takes time to apply the brake. Meantime your car speeds ahead. This first formula shows how

far you'll go if your reaction time is average. Multiplying your speed by 1½ gives the approximate number of feet the car will travel before you can react and hit the brake. And you still must stop.

The second formula shows about what



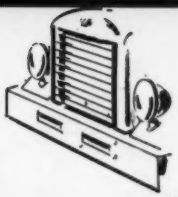
clear distance ahead you need for any speed—if you are to stop safely. Multiply your speed by the first digit of that speed. In the example above, it is 30 times three—or approximately 90 feet.

to miss an oncoming vehicle that swings wide over the dividing line.

There would be a lot fewer accidents if all drivers made certain they had enough clear space ahead before trying to pass. When a car is almost abreast of me and another car or truck suddenly appears coming in the opposite direction, I find it difficult to judge what the passing driver will do. Will he speed up—and make it? Or will he drop back? If I slow down, hoping he will pass, is he also likely to slow? As the best way out of such situations, truck drivers usually maintain the same speed. But don't count on that. It is safest to pass only when you are sure you have enough space.

Safety rules of the U. S. Interstate Commerce Commission require interstate trucks to stay far enough behind a preceding vehicle so an overtaking vehicle can enter and occupy this space without danger. Truck drivers know the practice of following too close as tail-gating.

What Truck Signals Mean



Drivers frequently flick their lights to pass information back and forth. Common signals:

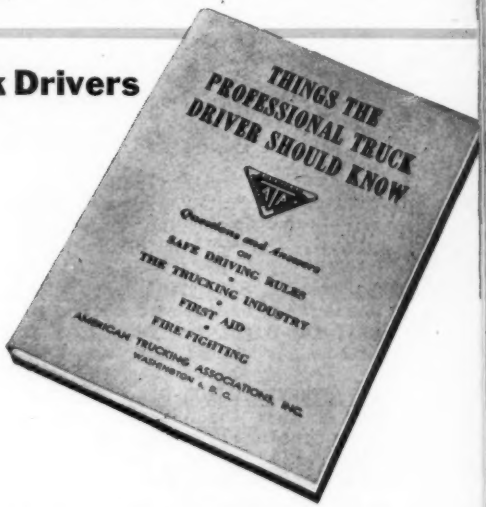
One flick—"Look out ahead." (Used to warn of such things as a wreck, a road obstruction, a police check.)

Two flicks—"Hello."

Three flicks—"I'm stopping. Please do the same."

In my opinion, police should place a reckless-driving charge against any motorist who consistently stays only five or 10 feet behind another vehicle at 50 or 60 on the highway. If the car ahead stopped suddenly, the man behind couldn't possibly react fast enough to avoid a pile up. END

REQUIRED Reading for Truck Drivers



TRUCK drivers who become champions know this 90-page booklet by heart. Samples of its questions and answers:

Q. How does a bumpy or choppy road surface affect stopping distance?

A. The tires spend part of the time off the surface, lessening friction and increasing stopping distance.

Q. How does the professional driver overcome the glare of oncoming headlights?

A. He directs his eyes toward the right-hand edge of the pavement.

Q. What are the first symptoms of carbon monoxide poisoning?

A. Drowsiness, lightheadedness, headache.

Q. What should a driver do when symptoms of carbon monoxide appear?

A. Park his vehicle, get out into the air until the symptoms disappear and thereafter ride with a window partly open.

Q. What is one simple method by which a driver can check brake equalization?

A. By feeling brake drums for heat after a series of light brake applications. An unusually hot or cold brake drum indicates that brakes need adjustment.

Q. What's a preventive for tire fires?

A. Check tire temperature frequently and see that air pressure is correct. Flat or low tires can cause troublesome fires.

Q. If stalled, wrecked or upset, what are the first two checks that should be made to determine your fire situation?

A. The first two checks that should be made to determine the fire situation of a disabled vehicle are (1) be sure the ignition is off; (2) check for leaking gasoline from fuel tank or broken lines. Fumes may accumulate and be ignited from a short, a static spark or careless smoking.

P.S.

Last minute news & notes...

WINTER WEARY? Dr. H. C. Willett, MIT meteorologist, forecasts a fairly prompt arrival of spring in mid-March in the eastern half of the U.S. January will be relatively mild, he says, while February will be cold again, with more snow. He predicts an open winter for the Southwest, and an average winter for the Pacific Northwest.

A NEW DRY CELL, Army developed, lasts twice as long as those now in use, although slightly more costly. It permits use of low-grade domestic manganese dioxide in place of high-grade imported ore . . . THAT OLD HORN SPEAKER up in the attic may be a treasure. A loudspeaker manufacturer says that "horn-loaded" speakers achieve higher efficiency, lower distortion and smoother response than present cone types . . . SECONDHAND TV SETS are being bought, sold and traded like secondhand cars in one Philadelphia store . . . INVENTION MINDED? Here are two things RCA's Sarnoff says are needed: an electronic method of amplifying light for TV and an electronic air conditioner for the home.

A SYNTHETIC MOTOR OIL, said to be better than the natural product, has been developed by Prestone. Tailor-made, it's designed to give quicker cold-weather starting, cut engine ping and plug fouling, free sticky valves, and clean the motor. Some consumers are reported to have found that it needs changing less frequently. Drawback: it costs two to three times as much as regular motor oil . . . BY USING RADIOACTIVE PISTON RINGS, oil-company engineers found that engine wear is increased by low operating temperatures, lean fuel mixtures, pinging. Additives reduce wear . . . EXPERIMENTAL GAS-TURBINE truck uses more fuel but could make up cost by extra load carried, Boeing reports. A sharp drop in fuel consumption is predicted for future turbines. . . . NEW ALARM SYSTEM made by Bendix Aviation tells bus drivers when their hydraulic systems are low on oil, threatening loss of brakes and steering power.

A SELF-SERVICE LAUNDRY is the latest thing in California drive-in movies: Drop your wash in as you enter, pick it up on the way home . . . LIFE EXPECTANCY is still going up. New U.S. average, based on '49 figures, is almost 68 years . . . OVERLY BOSSY FOREMEN breed accidents, according to University of Chicago. They make anxious workers more so . . . A NEW MOON has been found, but it's no use to earthbound lovers. This heavenly body revolves around far-away Jupiter, which already has 11. It shows up as a speck on a photographic plate exposed at Mount Wilson Observatory.

SEA SCORPIONS six feet long have been found in Ohio. But they don't have stingers. And they died about 400,000,000 years ago . . . HAWAII is silently dropping into the ocean --but it still has 70,000,000 years to go say geologists. Just to even things up, Baffin Island, in the Arctic, is rising six feet a century.

A NEW RUBBER-BASE PUTTY is said to resist vibrations better than ordinary kinds. It comes in colors . . . LATEST AIR FORCE TIRE CASING will take a 240-m.p.h. landing without blowing out, but is not much larger than ordinary auto-tire casing.

A VITAMIN B DEFICIENCY in the scalp is blamed for dandruff by researchers for National Vitamin Foundation. Ointments containing the missing vitamin cleared up dandruff temporarily; vitamins taken internally had no effect . . . PLASMA STORAGE methods may be changed. Research shows that cold-storage often preserves viruses such as jaundice, while storage at ordinary room temperature kills them . . . THE DREADED "STREP" GERM is the base of a new English antibiotic called streptozyme . . . NEWEST SLEEP DRUG, Dormison, is reported non-habit-forming, gives quick restful sleep.

The Editors

MECHANICS
and
HANDICRAFT
REG. U. S. PAT. OFF.

Electric Trains Are Fun All Year

Don't pack them away with the Christmas decorations. Give them a permanent place—and they'll give you a permanent hobby.

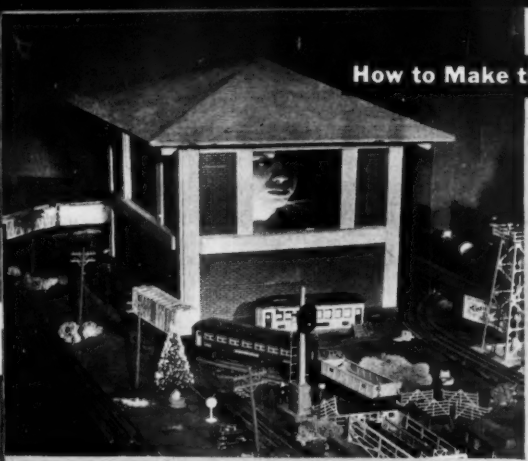
By Henry Abraham

MANY a new electric train highballs under the tree on Christmas morning. For a couple of weeks it runs on a rush schedule, with Dad pulling the throttle as often as Junior. But about January third, Dad gets back to the newspapers and Junior finds the sledding is wonderful.

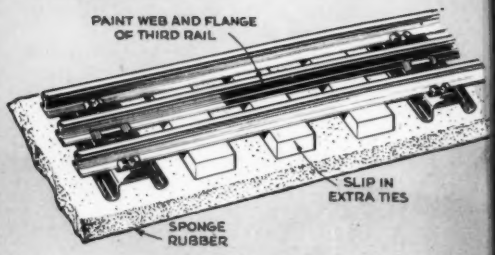
That's when Mom pulls the track apart and retires the rolling stock to a closet roundhouse. If Dad and Junior notice, it is with relief at escaping the cleanup chore.

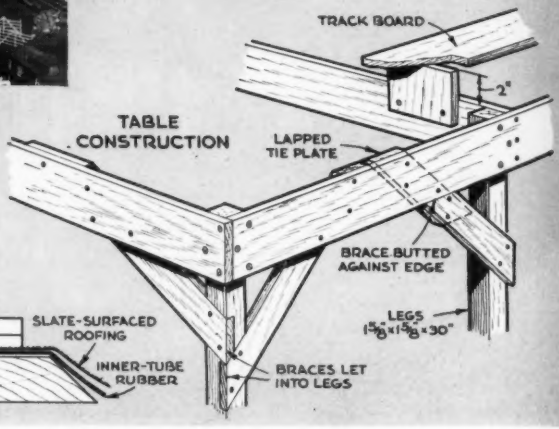
How come? Why does a train lose its appeal? Nine times out of 10, it is because the layout is on the floor. That's like putting glue on a fielder's mitt. You just can't play

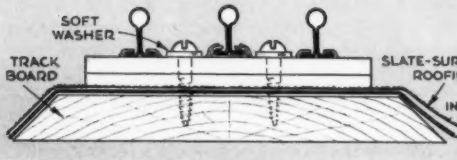
How to Make the Most of Tinplate



CONTROL PIT inside table gives a full view of train movements on this slick O-gauge layout. The switch tower in which the operator sits has only two walls and can be lifted off easily.







that way. Dad gets cricks in his back, Mom can't clean, track and rolling stock are stepped on, and Junior realizes that broadloom doesn't look much like scenery.

Keep it rolling. Model railroading is too much fun to let this happen. But if the model pike is to be ready for the kids on a rainy afternoon—and for Dad to play Casey Jones after supper—the layout must be set up so that it can be used any time. That entails mounting it permanently *off* the floor, so that the tedious chores of setting it up and packing it away are unnecessary.

My own real interest in the hobby, for example, began only when the trains were mounted on tables. In the 12 years since, my enthusiasm has grown along with my layout, which now nearly fills a big cellar.

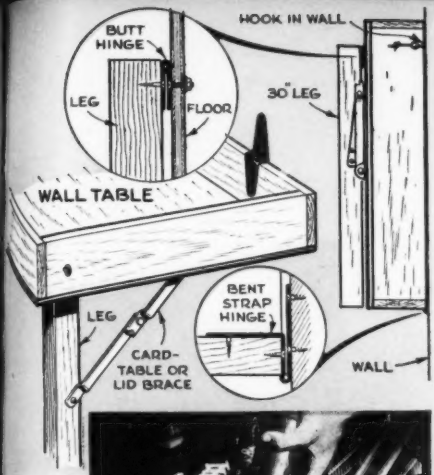
Where to put it? A good site for your permanent layout is the attic, cellar, garage or spare room. But if you don't have any of these to pick from, you can hinge the track panel to a wall along one edge and hinge drop legs to the outer edge. This gives you a railroad that folds out of the way when not needed. Another dodge is to put casters on the panel so that it can be rolled under a bed.

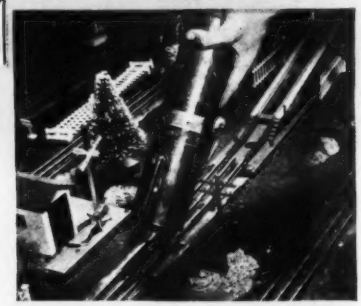
If you have a choice, the cellar is usually the best location. In an attic, low headroom may make much of the floor unusable, and winter cold and summer heat are extreme, whereas a cellar is moderately comfortable at most times. A garage layout may be all right in Florida, but I'd rather not have one in Maine or Wyoming.

A spare room is fine if it's really spare. You don't want to pull spikes every time cousin Agnes comes visiting.

Tinplate or scale? Once you've decided where to put your permanent railway, plan the layout. This depends a good deal on the equipment you have. *Tinplate* models, the kind that start many a model railroader off, get the name from their tinplate tracks. The curves are sharper than scale curves, and they don't look much like real rails. But you can push the sections together, clip on the power leads and have a train running in five minutes.

Scale track is a miniature version of the





RAYON FLOCK, blown from handgun, becomes grass, sand or ballast.

real thing. Rails are solid brass, aluminum or steel, spiked to wood or fiber ties. You can spike your own rails or buy them ready-mounted.

Maybe, like me, you'll start with tinplate and go on to scale later. Let's assume you have tinplate now, and see how you can make the most of it.

Any layout worth the name will eventually need room for turnouts and parallel tracks, so your space should be at least 4′ by 8′. I recommend making a drawing of your railroad-to-be on paper ruled into squares, each representing one square foot. Be sure to allow room for trackage and features you will want to add later—including those you haven't thought of yet!

Don't be a flatlander. If you want a realistic layout—and I think that a lot of the fun lies in making it look like the real thing—don't put your tracks on a flat, overgrown table. Only a scenic artist can make a flat plywood panel look like anything else. Instead, build a supporting framework 30″ high and on it put just enough flat stock to form your roadbed. Better still, mount the track boards on supports 2″ above the table framework.

This construction permits a greater variety of scenery. Hills, valleys, rivers, cuts and fills are easier to create. The open spaces between tracks are filled at different levels with plywood, scrap lumber and wire screening. Plaster applied over this transforms it into realistic terrain.

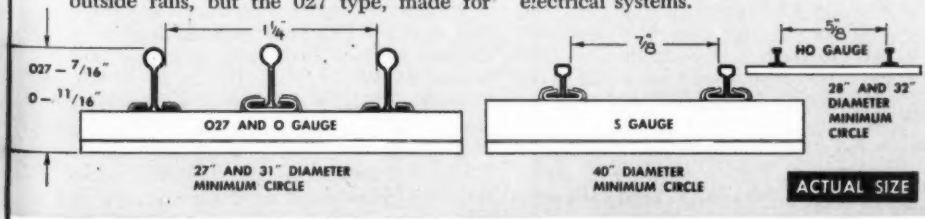
And while you're building the supports, don't forget that noise will be a problem. Put a sound-absorbing layer of thick felt, ⅜″ sponge rubber, cork board, roofing paper, or inner-tube rubber under the tracks. Even the screws that hold down the tracks conduct noise. Sound-insulate these with a bit of cardboard under each screwhead.

Don't omit any of the track-connecting pins. If any are loose, see if the rail has opened. If squeezing it back into shape doesn't remedy matters, bend the pins slightly to make them a tight push fit. The inside of all rail joints should be flush, or you can expect derailments and noisy run-

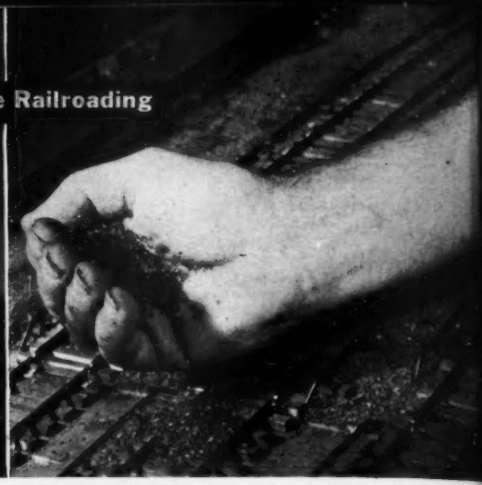
How Tinplate Gauges Compare

The 2½″-gauge trains Dad played with are museum stuff now. Today's standard tinplate is 0 gauge. It is all 1¼″ between outside rails, but the 027 type, made for compact layouts, turns sharper curves and is lower than regular 0. The two cannot readily be mixed.

S-gauge tinplate and HO-gauge tinplate both have square rails and two-rail electrical systems.



YOU'RE NEVER DONE, once hobby has a good hold. Here author lays new track to turntable (at rear). Solid rails are spiked to wooden ties. Ability to solder is a must.



TRACK BALLAST is bird gravel, dyed gray. Outside third rail makes for simpler wiring than a two-rail system, and closely resembles full-size electrified construction.

ning as the wheel flanges pass the joints.

Make it look real. Gray sponge rubber, beveled at the edges, looks like a ballasted roadbed. So does slate-surfaced roofing paper. Or you can paint the roadbed with glue and sprinkle on bird gravel.

Sand, dirt and grass surfaces are nicely imitated with flock—tiny rayon fibers you blow on over an adhesive coating. It comes in all colors.

Extra ties, cut from wood and stained or painted dark brown or black, improve the appearance of tinplate track. One manufacturer makes flexible O-gauge tinplate track in 3′ lengths mounted on closely spaced wood ties. It can be curved and will mate with regular tinplate track and switches. The center third rail on O-gauge tinplate can be made less conspicuous by painting its flange and sides—but not the top, of course—the same color as the roadbed.

How many rails? For complete realism, many hobbyists prefer a two-rail system. In this, the running rails are insulated from each other. Both serve as conductors. Current flows into the wheels on one side, through the motor and out through the wheels on the other side.

Converting O-gauge tinplate to two-rail, however, is costly and complicated. It's probably wiser to start with what you have, and use ingenuity to make the most of it.

Don't stop with tracks and scenery. Houses and railway structures can be bought in kit form at hobby shops—also scale trees, shrubs, fences and farm animals.

Next step: DC. Once you get going, you may want to convert to direct-current operation. This will give you instant, positive reversing instead of the seesaw operation common to alternating-current reversing. You will know before turning on power which way the engine is going to run and so will be able to move the trains realistically.

For direct current, you must add a rectifier to your transformer. Ask your hobby dealer for one that will handle the maximum voltage and output (in watts) of your transformer. You can use the old speed control on the transformer, but will need an extra double-pole, double-throw switch. This controls train direction by reversing the polarity of the track.

You will also need a small rectifier for each locomotive. It must be connected across the field winding of the motor so as to keep current flowing the same way in the field even when you reverse it in the armature. Then the motor runs the other way. Let an experienced model fan help you with this unless you know your engine and can get instructions for wiring the rectifier.

No track changes are necessary, and you'll find that on DC your engines start in a slower, more realistic way and can pull heavier loads.

Rolling stock. You can add greater realism to your tinplate layout by getting scale freight cars and putting on tinplate trucks. Kits can be bought with either kind of trucks. They come in a larger variety of

IT'S A SMALL WORLD, but this corner of Henry Abraham's scale layout shows how real it can look. Trap doors like one he's standing in give access to any part of system. His locomotives run on direct current. Transformers and rectifiers that supply power are housed in a ventilated case just under switch-studded control panel shown below.

car types than the non-scale ready-mades, and, because you put them together yourself, are cheaper. Don't, however, buy scale engines or passenger cars for tinplate track, as these are too long for the short-radius curves and their small wheel flanges will not hold the rails.

If you ever want to convert to two-rail scale track, you can adapt both the scale stock and your original tinplate cars by simply substituting scale trucks. To convert your engine, though, you'll have to turn down the wheel flanges. Unless you have a lathe and experience, better leave this job to your hobby dealer.

Pointers that pay. Twelve years of this hobby have taught me some things the hard way:

- Don't use bell wire for connections. The covering unwinds, causing shorts. Use No. 16 or 18 rubber-covered stranded wire.
- Solder connections whenever possible, especially those to clip-on (Fahnestock) terminals. Then you won't have to track down open circuits.
- Solder track joints, too, once you are sure the layout is permanent. This will insure good electrical continuity.
- Build your control board on a plywood panel separate from the layout. Then it can easily be altered when you make changes—as you undoubtedly will.

These are just suggestions. One of the pleasures of model railroading is that your system develops just the way you want it to. You're the boss—so go to it! END

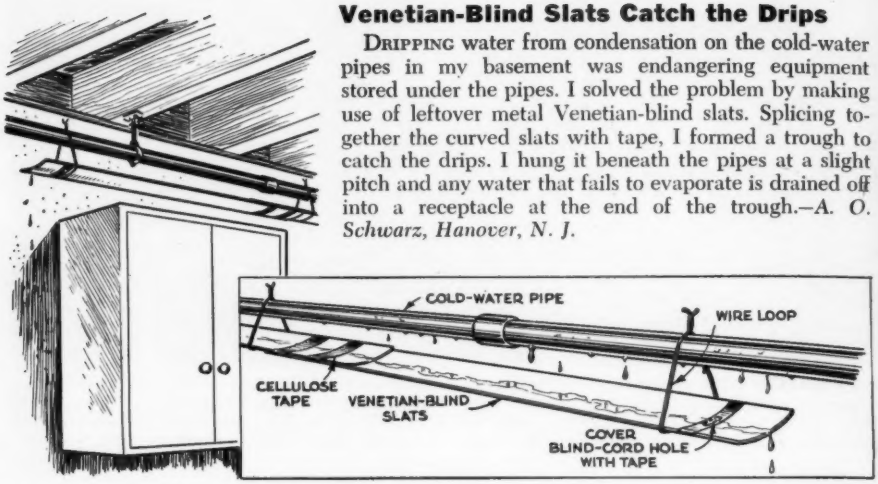
About the Author

HENRY ABRAHAM, an insurance agent, didn't dream what he was starting when he moved the kids' trains into the cellar. In 12 years, the layout, converted to scale, grew to 30′ by 45′.

Being civic minded, Abraham makes his hobby serve the community. Boys from the neighborhood Police Athletic League and Boy Scouts are weekly visitors. Since 1942 he has put on a yearly show that packs in adults as well as youngsters. Receipts from a 10-cent admission go to the Red Cross. In 1951 they totaled $350.

The payment Abraham received for this article went to make a long-cherished dream come true. He traveled 3,600 miles—by train—to visit a model pike even bigger than his.

Venetian-Blind Slats Catch the Drips

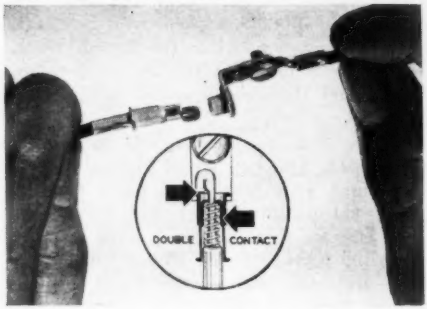


DRIPPING water from condensation on the cold-water pipes in my basement was endangering equipment stored under the pipes. I solved the problem by making use of leftover metal Venetian-blind slats. Splicing together the curved slats with tape, I formed a trough to catch the drips. I hung it beneath the pipes at a slight pitch and any water that fails to evaporate is drained off into a receptacle at the end of the trough.—*A. O. Schwarz, Hanover, N. J.*

Photo Meter Is Matchbox Size

ONE of the smallest exposure meters made in the U. S., the new Mascot pictured below has four lens-opening or f-number scales. Each scale is pegged to a different film-speed index number—5, 10, 16 or 50—and gives a direct reading of the correct f number for use with 1/25-second shutter speed. If you want to use a different shutter speed or your camera is loaded with film having a speed not included on the rotating scale, you consult an accompanying chart to determine which scale to use. Made by GE, it is priced at $16.95.

Spring Locks Wire Connector



CONNECTING or separating two wires is easy with this new plug. Its tip hooks over a collar in the socket made to be used with it, and holds the plug firmly in place until a light tug on the spring-loaded flange centers the hook and thus lets it slip out. The makers, Harvey Hubbell, Inc., Bridgeport, Conn., also use these connectors on key chains.

Shingles Help You Hang a Door

WHEN you hang a door, cedar shingles will wedge it above the sill so that it'll swing freely after the hinges are fastened. Draw lines across the shingles just where they're thick enough to lift the door for proper clearance. Tap the shingles under the bottom edge of the door until the pencil lines disappear. To plumb the door, use shingles at each side.—*J. R. E. Cameron, Vaucroft Beach, B. C.*

Tune Your TV Set from Across the Room

You pick programs by remote control with this simple armchair tuner that fits most receivers.

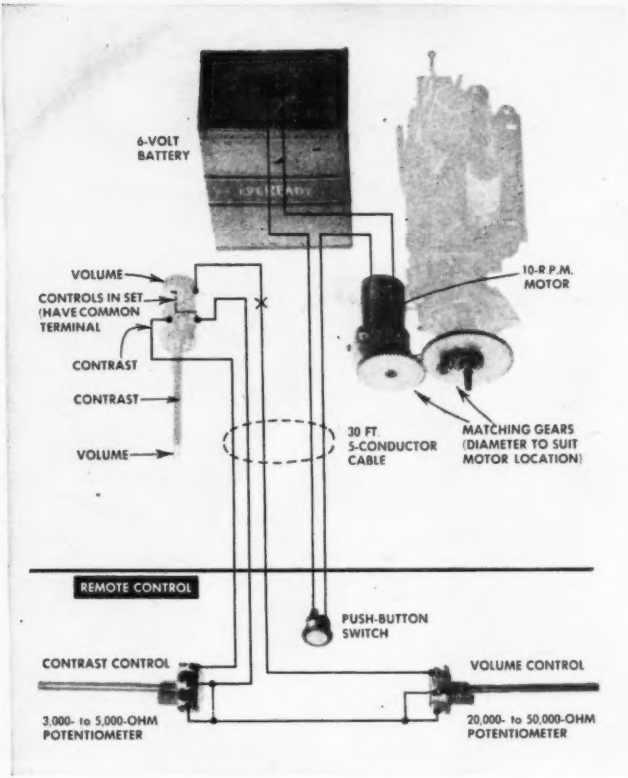
By Alan W. Baldwin

YOU can really lean back and enjoy the TV shows when you don't have to keep getting up to change stations. This remote-control tuner lets you switch channels and adjust volume and contrast without stirring from your easy chair.

The parts for such a convenient device can be bought for less than $10. It can be fitted to a large number of receivers now in use. Since it changes channels mechanically, there's no danger of upsetting delicate electronic adjustments.

How it works. A small motor and three gears, which you install right on the TV chassis, turn the station-selector switch. They do mechanically exactly what you now do by hand. Two potentiometers wired across two controls in the receiver provide remote control of contrast and volume.

These are the essential parts of the remote control. They are shown in their simplest form in the photo-diagram of the



TWO CONTROLS and a button are in the simple remote tuner shown in photo-diagram at left. Control unit, at bottom, is connected to the set by a five-wire cable. The shadowed parts at top are already in the receiver; the battery, motor and gears must be added.

You can tuck the battery anywhere in or behind the TV cabinet, but it's best to mount the motor in line with the station selector so you can gear the shafts together as shown on a following page.

Volume and contrast potentiometers in the set may be separate, but more commonly they are combined in a dual control as shown here. Usually they have a common connection. Wire the common (negative) side to both remote potentiometers, and connect the positive terminals to corresponding lugs on the remote units. Do not disturb or remove any wiring in the receiver.

battery-powered control pictured above. The slightly more elaborate version on the next page also has a remote on-off switch and a different power supply for the motor.

Planning the installation. Since telesets differ widely, you have to fit the remote control device to your set. Begin by checking the receiver on these points:

1. Does the station switch operate on the *sleeve* or the *shaft* of the set's tuning assembly? Most sets have two concentric tuning controls—one for station switching, the other for fine tuning. Either sleeve-switching or shaft-switching sets can be adapted, but the rig is a bit different.

2. The channel selector should have definite stops, clicking into place when you tune the set remotely. If the switch detents are sloppy or loose, adjust them for easy but positive action.

3. Find suitable space for the motor. In the installations pictured, the motor is mounted alongside the tuning assembly and geared directly to the station selector. If your set does not permit this, mount the motor where you can and turn the switch with sprockets and a small ladder chain.

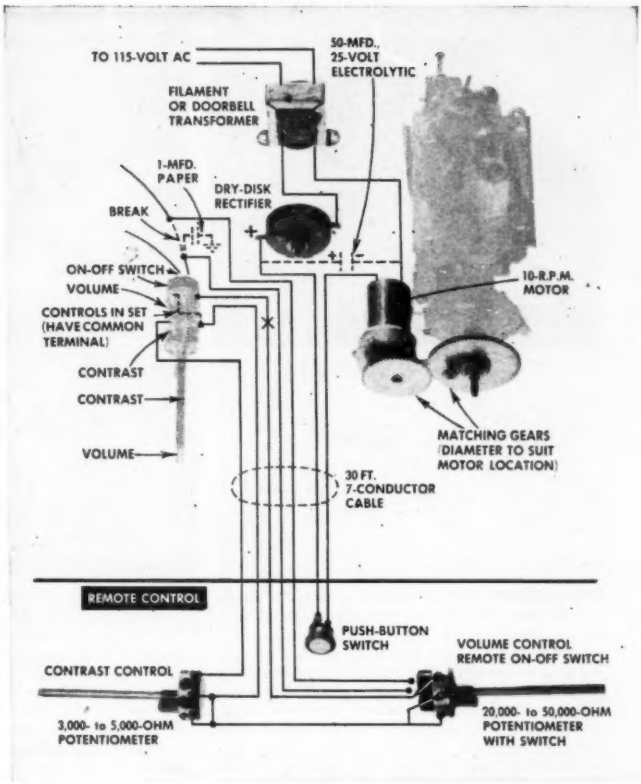
Though the remote control will work on most sets, there are some with which it cannot be used. The station switch on the receiver must be able to move continuously in one direction, because the motor and gears turn only one way. And since this control has no provision for fine tuning, it should not be used on a set that needs frequent fine tuning. If your set does, have it carefully aligned before making this tuner.

Selecting the parts. The motor you buy should have an internal reduction gear. It must have enough torque to turn the selector switch. If you can stop the motor with your fingers, it probably is not husky enough. It should be geared to about 10 r.p.m. to change stations at a comfortable, controllable speed. Suitable six- to 12-volt midget DC motors are available.

AN ON-OFF SWITCH can be added to the unit shown on the previous page, and the battery replaced by a transformer and rectifier. Seven conductors go to this remote unit (you may find standard eight-wire cable easier to obtain).

Break one of the two connections to the on-off switch in the receiver and reconnect the cut ends through the switch on the remote volume control. This puts the local and remote switches in series so either one turns the set off. But both must be on before the set will operate.

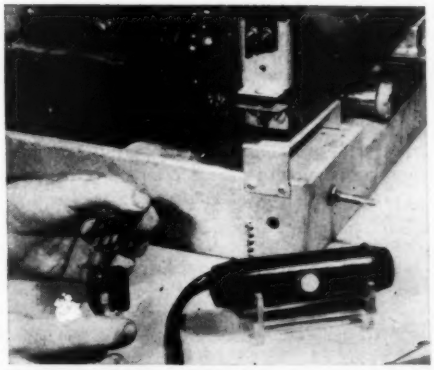
Mount the transformer in any convenient space on or under the chassis; locate rectifier where it will get some ventilation. If a six-volt transformer does not deliver enough power through the rectifier to drive the motor, connect a 50-mfd., 25-volt electrolytic condenser as shown by the dotted lines, or use a 12-volt transformer.



Since the motor draws current only while it is actually changing stations, a husky battery will last a long while. If you would rather do a little extra work now to avoid battery replacement, use a transformer and rectifier instead. A suitable dry-disk rectifier in combination with one or more filament or doorbell transformers can be picked up at many radio-parts stores. Before you actually install the power-supply parts, make sure they work with your motor.

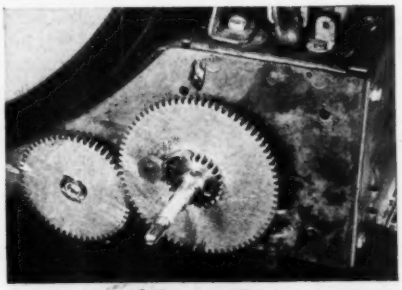
The remote potentiometers are not critical, and here, too, you have a lot of leeway in selecting them. Relatively low resistances are specified to reduce tendency for hum pickup. Low resistance, however, may also reduce signal strength. If you find that volume drops off too much, use a higher resistance for the remote volume control. And if the remote contrast control does not provide enough range, substitute a higher value for it.

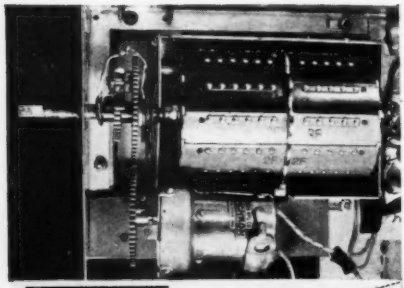
If excessive hum develops, insert a

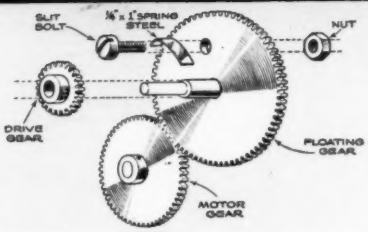


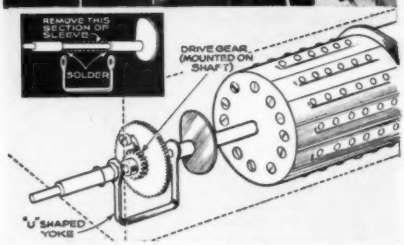
PLUG-AND-SOCKET CONNECTORS to permit removal of the remote unit are handy but not necessary. If your armchair tuner includes a series-wired on-off switch, install an extra switch on the chassis to close the power circuit when the remote tuner is unplugged. Other circuits remain the same. A hollow plastic cylinder, just big enough to take the pots, makes a neat housing for the unit.

How to Gear the Motor to the Station Selector









IF THE SLEEVE of the tuning assembly turns the station-selector switch, the tuning motor can be geared this way. Gear diameter is governed by the location of the motor. All gears should have matching teeth. The large gear is a free fit on the tuner sleeve; drive and motor gears are fastened with setscrews. The motor turns the drive gear through a clock-spring ratchet. This arrangement permits manual tuning in the direction of the ratchet.

IF THE SHAFT of the tuning assembly turns the station-selector switch, part of the fine-tuning sleeve must be cut away. Soldering a U-shaped yoke to the cut ends restores manual control of the fine tuning. Other details are the same as those shown at the left. A gear ratio of about 2 to 1 provides satisfactory tuning speed with a 10-r.p.m. motor. If the motor turns the wrong way, reverse the two connections that go to it.

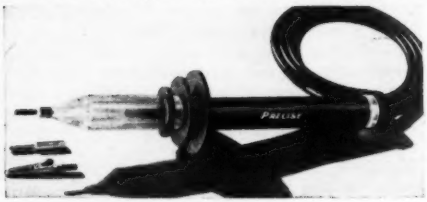
.1-mfd., 400-volt paper condenser in the remote volume-control lead at the point marked X in the photo-diagrams. And if you hear a whistling or "rushing" sound, connect a .01-mfd., 400-volt paper condenser across the two outer terminals of the contrast control in the set.

The two 115-volt leads required for a remote on-off switch may introduce some hum. To overcome it, ground one switch terminal through a 1-mfd., 200-volt paper condenser as shown by the dotted line.

Operating the remote control. The volume and contrast controls in the armchair tuner govern the same circuits as those in the receiver. To keep the two pairs of controls from limiting each other, set the ones that *are not being used* to maximum.

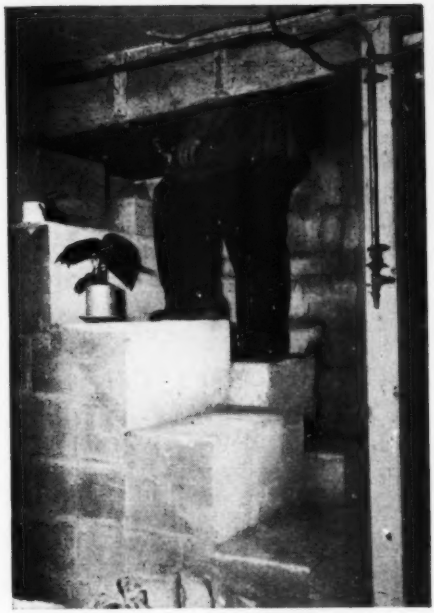
When you press the push button on the remote control, the motor turns the station-selector switch. After you have worked it a few times to get the feel and timing, you will find it a cinch to pick out a station as the channels march around. END

Probe Adapts Meters for High-Voltage TV Tests



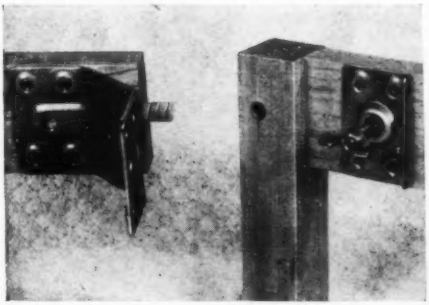
THIS high-voltage probe can extend the range of most vacuum-tube voltmeters and multitesters to 30,000 volts. Resistors in the probe can be interchanged to adapt it for use with almost any meter having a sensitivity of 5,000 ohms per volt or more. Precise Development Corp., Oceanside, N.Y., makes the probe.

Offset Stairs Save Space

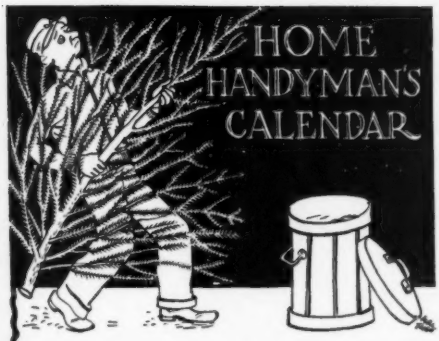


OFFSET stairs like these, made of surfaced concrete blocks, are fine if you remember to start up or down with the correct foot. Where space is lacking to build stairs of normal rise and tread, offsetting them reduces the length of run, yet gives normal tread on each step.—*Stephen Greene, West Dover, Vt.*

Corner Brace for Furniture

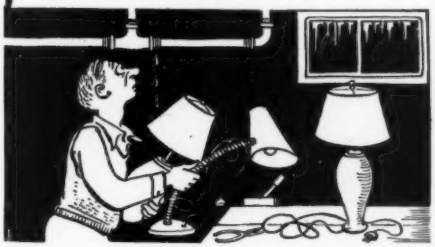


THIS corner brace, designed for wooden bedframes, can be used on chairs, tables and other pieces of furniture. Once it is installed, no tools are needed for assembly or disassembly. The wing nut and bolt hold the parts rigidly. Rudolph Industries, Holland, Mich., is the maker.

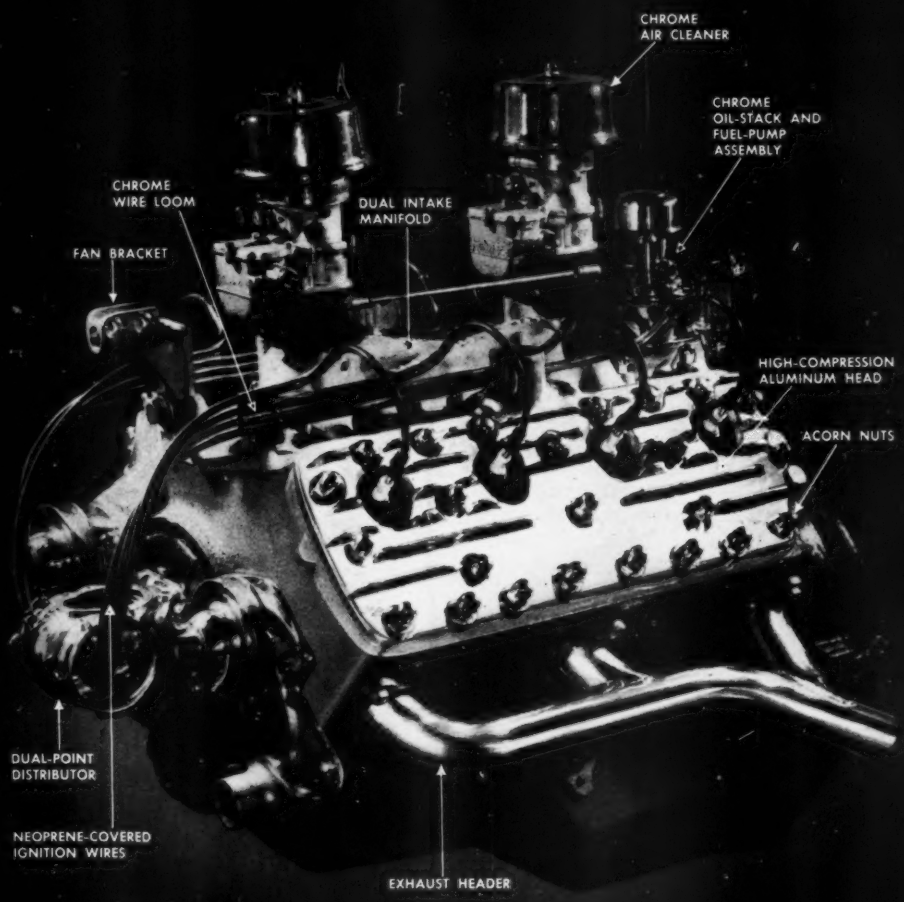


January This chill winter month of brave new resolutions may well be dedicated to indoor chores.

- Have you disposed of that dried-out Christmas tree? While you're at it, search out other trash, rubbish, oil-soaked rags, anything that might be a fire hazard.
- Check the wiring of lamps and appliances; replace worn cords and broken parts. Oil electric motors and squeaky hinges. Repair any broken locks, latches and bolts. Tighten loose doorknobs.
- Drain and refill the steam boiler. Inspect the hot-water tanks and pipes. Rust and dripping faucets are always signs of plumbing trouble to come.
- More time to spare? Why not build some extra shelves? These you always need. You can finish attic rooms or build a basement rumpus room, ignoring winter winds outside.
- There's one outside chore you mustn't overlook. Remove ice and snow from roofs and gutters before the load gets dangerously heavy. A sudden change in weather may cause extensive damage if this is neglected. Also, if you'll be needing new fences or rustic furniture, now is the time to cut your posts and poles. There's less checking and cracking in winter-seasoned wood.



How an Expert Soups a Stock V-8



A few of the many souping accessories made for a V-8. Standard caps go on the distributor.

A racing driver tells you how $250 worth of work and accessories can nearly double a V-8's power.

By James Pauley

JAMES PAULEY

PACKING new horses under the hood is a large part of my business. The work I do runs all the way from conservative souping—which gives the Detroit product a bit more sass—to a full-dress hop-up, which can double the brake horsepower delivered to the transmission.

People sometimes wonder why Detroit doesn't build in this extra power, especially since any good mechanic can do the job without difficulty. The answer is that pure power is only one of many things the bulk of car buyers want. They also want quietness, dependability, smoothness at low speeds, high gas economy and a long run between overhauls.

They get these things, too. But when an engine is souped up, other characteristics necessarily slack off. While a slight boost in compression may improve gas mileage, a larger boost will make a car pretty choosy at the gas pumps. A racing camshaft will let an engine wind up far above its old peak r.p.m., but then it will run rough, buck and backfire at low speeds. And the greater stresses of high-output operation naturally shorten the time between overhauls.

This doesn't mean that boosting power is a short-sighted deal. You can juice up an engine so it will out-perform its brothers and still be quiet, reliable and eminently suited for trips to the grocery store.

In converting a car from stock to sports use, many enthusiasts work from the outside in. They install high-compression heads, twin carbs, and perhaps a set of dual mufflers. All these help to boost power, but that's only a start. To get the most out of an engine, you should work from the inside out (see "How 'Soupers' Pep Up Stock Engines," PS, Dec. '51, p. 189).

That way you get rid of basic defects that outside accessories couldn't overcome.

What engine to use. An L-head engine has definite souping limitations. For one thing, the shape of its combustion chamber makes the initial gas expansion take place over the valves—instead of over the piston, where it belongs. For all-out power, double overhead cams and inclined overhead valves in a hemispherical chamber are the combination to dream about.

Still, you can do a lot with an L-head. The most popular souping block is a Ford V-8 of the 24-stud variety. This is the 85- or 95-hp. power plant built in 1939 and later. It's a good engine to work on because it has an excellent strength margin, a large-diameter crankshaft and insert-type bearings.

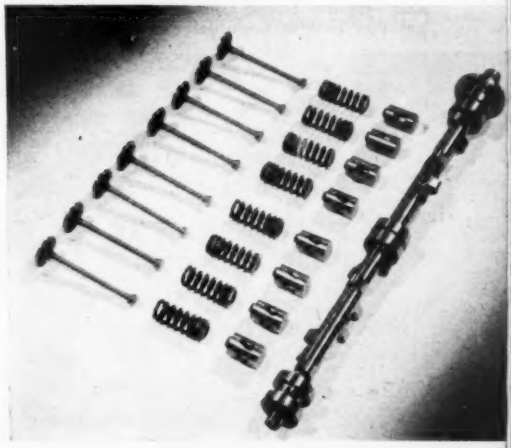
Some time ago I worked over one of the 85s. With a Mercury crankshaft, a bore of 3 3/16″, a stroke of 4″, a power cam and 8.5:1 compression with dual carbs, we got a dynamometer reading of 158 hp. at 4,600 r.p.m.—and that's a nice bit of stuff. Such a job might run around $250, doing some of the work yourself.

Let me tell you how I would do it.

How to start. First, I would pull out the engine, take it down completely and wash off all sludge and grease. It pays to be almost surgically clean in engine work. Then I would inspect the crankshaft with care. If it was more than .0005″ out of round or showed any score marks, I would have it reground. Naturally this would also mean buying new bearings to suit.

If I found any out-of-roundness in the cylinders, I would have the block rebored. But chances are I'd have it rebored anyway

A REGROUND CAMSHAFT and parts that go above it—adjustable tappets to compensate for metal ground from cam lobes, heavier springs to help reduce valve floating at high r.p.m., and a set of valves.



to increase the engine displacement. This costs from $2 to $5 a hole, depending on the shop. The 85-hp. Ford can be bored out to Mercury size, giving the engine an additional 18 cu. in.

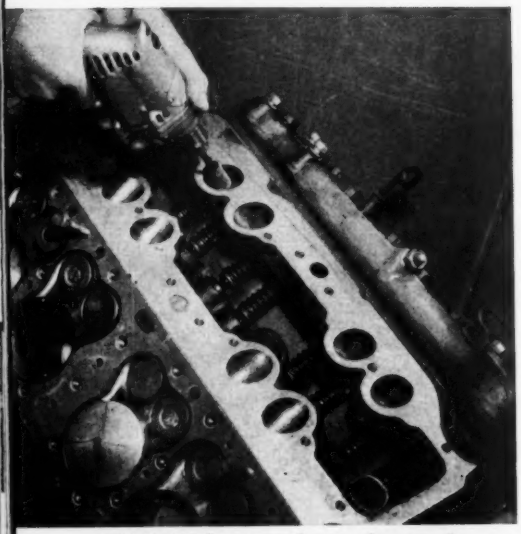
For a full-scale job, I would also put in a 1949 Mercury crankshaft. This crank fits the older Ford models nicely and it has a ¼″ longer stroke—another way of increasing displacement. A new Mercury crank costs a little less than $40.

The availability of this crank is why I never consider, for this job, stroking the stock Ford crank. (Stroking consists of grinding down the diameter of the crankpins, giving them new centers, to increase the piston travel.) About the best you could expect from stroking would be ⅛″. The Mercury crank gives you ¼″ without fuss or bother, it's stronger and costs no more.

With rebored cylinders you need new pistons. A set of the three-ring type (about $3.10 each) fitted to .003″ skirt clearance will make the engine free-working and give good oil mileage. Since the cylinder bores will be true, a steel section ring and inner ring will not be necessary; plain cast-iron rings will serve.

Porting and relieving. These are two more highly desirable steps. They will let the engine breathe a lot better, taking in a bigger charge of the power-giving mixture and expelling it more efficiently. The manufacturer doesn't spend extra time and money on these refinements, but they make a whale of a difference. Porting and relieving are jobs you can undertake yourself, or you can have them done for around $36.

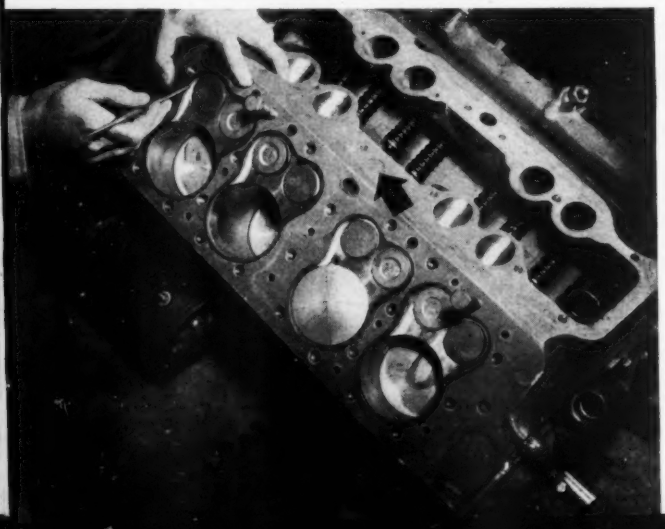
Next I'd turn my attention to the oil drain-back hole located in the front of the block under the cam gear. Its purpose is to feed oil from the relief valve to the timing gears. I would drill this hole 11/32″, tap it with a ⅛″ pipe tap, drill a 1/16″ hole lengthwise through a ⅛″ pipe plug, and install the plug in the hole. The reason for this: If the

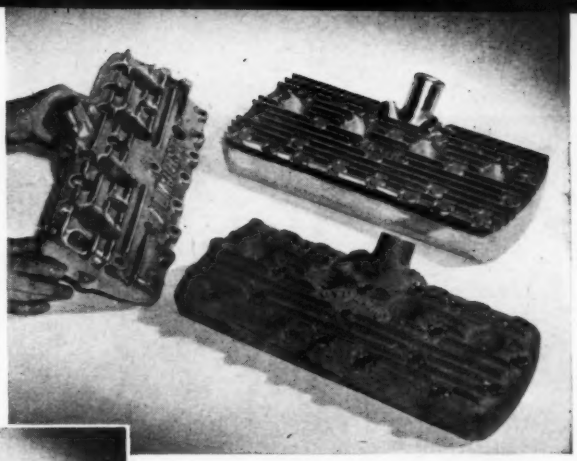


PORTING enlarges and smooths out the gas-flow path between manifold and cylinders. Metal is removed with a rotary file to straighten out the path as much as possible. Surfaces are smoothed with rubber abrasive wheel.

RELIEVING. In this process, you remove metal from top of block between the valve seats and cylinder bores. Object is to increase the gas-flow area between valve and cylinder. On intake stroke, this permits more fuel to sweep into cylinder. On exhaust, it gives the gases a bigger path and helps reduce back pressure. This photo shows a good way to keep your relieving within limits. Rest a gasket on the block and secure it with a couple of studs. Then scribe around inside of gasket openings between ports and cylinder.

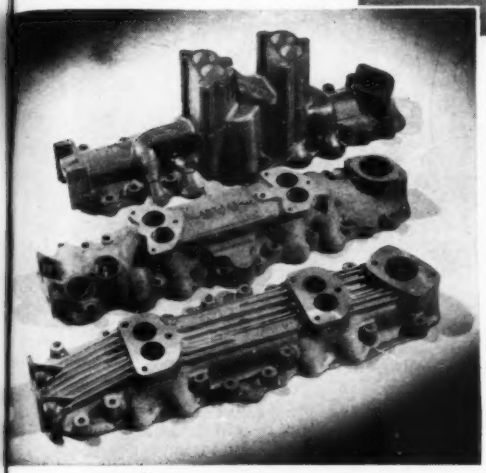
Remove metal to a depth of about 5/32″ at cylinder edge, sloping it back flush with valve ports. Grind sides to a gentle radius, avoiding sharp corners. Use a rotary file or small grinding wheel in an electric drill. After metal is removed, polish surface with a dentist's rubber abrasive wheel. Arrow indicates how copper pennies can be used to block heat-riser tubes.





HIGH-COMPRESSION HEADS are easy way to get more power. The 21-stud head in foreground is for Fords from 1932 through 1938, others for later 24-stud Ford and Mercury blocks. Fins help dissipate heat.

DUAL INTAKE MANIFOLDS for V-8s are shown below. One in background is high-riser type. Mounting plate at right end takes fuel pump, oil stack and breather-cap assembly.



relief valve should ever stick open, there would still be some oil pressure.

Before leaving the block, I'd replace the camshaft bushings. This would help insure good oil pressure and valve operation.

Choosing a camshaft. For a road car that can also be used in a limited way for competition, I like a camshaft with a power grind—"jumping stick" in race-car slang. This stick is all acceleration. Power begins to develop around 1,200 r.p.m. and increases in a steady curve to about 5,800 r.p.m. Yet the engine will idle nicely and be smooth enough at low speeds to carry Aunt Tillie on shopping trips. This cam costs around $35 with the old one in trade.

A full-race or super-race cam is designed to deliver peak horsepower only at speeds in excess of 80 or 90 m.p.h. Below that speed it serves no useful purpose.

Whatever the cam, I would be careful to set the valves at the exact clearance specified. For instance, if the instructions give .007″ exhaust-valve clearance, I know that .009″ would disturb timing with consequent loss of performance. I'd grind in the valves to show a good matte surface all around the seat and use Lincoln Zephyr valve springs (30 cents each). These will keep the cam followers from bouncing at high r.p.m.

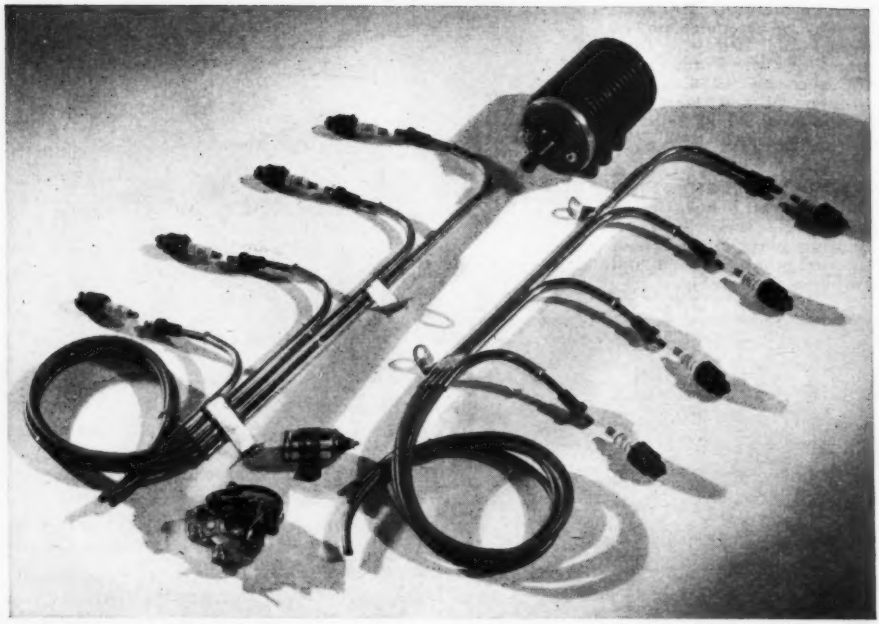
High-compression heads. Aluminum hi-comp heads usually are far more satisfactory than milling off a stock cast-iron head to decrease the combustion space. With the latter, overheating becomes a problem at high speeds. Pistons and valves come too close to the top of the head, and chances are the head would have to be relieved over the pistons and valves.

Many good aluminum heads are on the market. A typical cost is about $75 a pair. A lot of people don't know that the Ford Motor Co. itself puts out hi-comp heads. These, I think, are every bit as good as the ones put out by the specialty shops—and the cost is less, around $40.

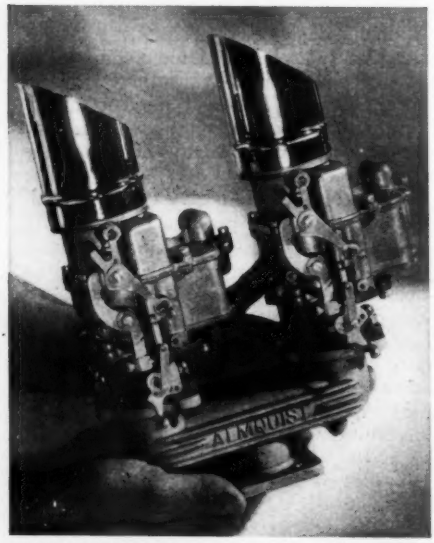
Unless I planned to race with alcohol-blended fuels, a compression ratio of 8.5:1 is about as high as I would want to go with ordinary high-test gasoline. Anything higher would necessitate retarding the spark and sacrificing performance.

To help engine breathing, you need an intake manifold that's free of obstructions and sharp bends. I would install one of the dual-carburetor manifolds that are made especially for the Ford V-8. But before installing the manifold, I'd block off the heat-riser tubes in the cylinder block with copper pennies. Heat in the manifold cuts down volumetric efficiency. Manifold and extra carb run around $50.

Dual exhausts. These are a definite help. The existing Ford exhaust system is designed for normal r.p.m. and a single carburetor. When cam timing is changed, dual



HOT SPARKS FOR HIGH SPEEDS come from ignition outfits like this. Racing coil at top right is air-cooled. At lower left is a dual-point conversion unit, plus condenser. On either side are chrome ignition-wire holders. Cooler plugs are usually needed.



TWIN CARBURETORS can be mounted on stock manifold with adapter like this. Such a setup is claimed to keep each carburetor operating in its maximum economy and efficiency range. Velocity stacks often replace air cleaners on souped engines, especially race jobs.

carbs are installed and compression is raised, a single pipe does not permit good scavenging of the exhaust gases. Back pressure occurs. Exhaust gas left in the cylinder weakens the new charge and causes overheating, resulting in either detonation or pre-ignition. Several good dual-exhaust systems are on the market, or I might make up my own, using stock Ford parts. Some people like the deep tone of the open Hollywood-type muffler, but John Law may not.

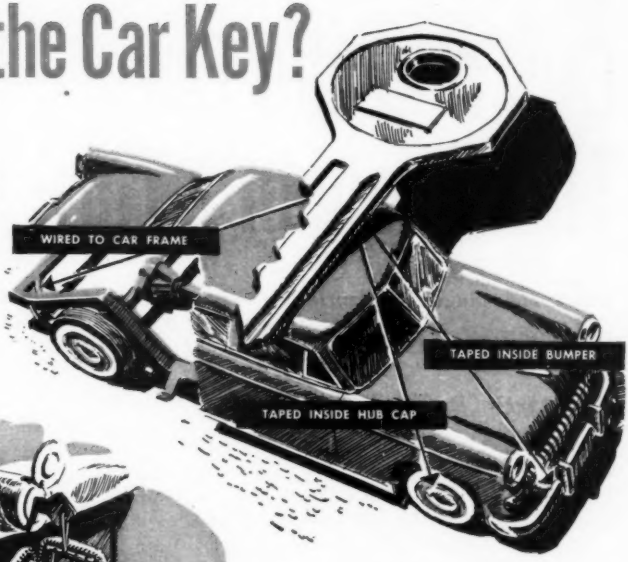
The standard Ford ignition system, with double springs behind the contact points, will work out very well up to 5,000 or 6,000 r.p.m.—and that's about all you ever would want on this particular job.

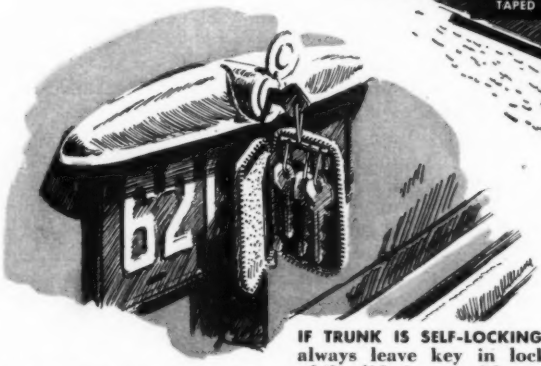
To use the new power and speed, the chassis must be suitable. Brakes are very important naturally. Hydraulic systems for Fords as early as 1932 models are available, and they are not hard to mount. Springs get "tired" from age and lose their elasticity. Good springs, and shock absorbers to control their action, are an absolute necessity.

And above all, I'd be sure the steering parts and front end were free of play and stiffness. Going into a high-speed turn, I'd then feel a lot better. END

Where's the Car Key?

THAT BIT OF BRASS is vital but often elusive. To avoid being hung up by a lost key, many autoists hide a spare one outside. The spots shown at right are favorite ones, but there are lots of others. Wire or tape it securely.





NOTE THE NUMBER of each car key on a slip of paper and keep it in your wallet or other safe spot. You can then get a replacement faster.

IF TRUNK IS SELF-LOCKING, always leave key in lock while lid is up. If you don't, you may accidentally slam lid with keys inside.

NEVER LEAVE KEYS in the ignition while car is parked on the street. Besides inviting theft, this is a violation of local law in many communities.

MAKE IT A HABIT to feel for your keys before locking the doors if your car is the kind that can be locked without key. Otherwise you may lock key inside.

CHECK TROUSER CUFFS when your key is lost. Missing keys are frequently discovered there.

A DROP OF SOLDER to close each snap hook in a key holder will keep keys from slipping off. Otherwise, single keys can be lost even if holder isn't.

Gus and the Car That Wouldn't Turn Left

Doc Evants diagnosed Gabriella's temperamental behavior as some sort of warning—but Gus figured all she needed was a little discipline with the business end of a monkey wrench.

By Martin Bunn

ON A cold, brisk Sunday a few weeks ago, Gus Wilson was enjoying an afternoon off from his chores at the Model Garage by strolling through town. Suddenly a chorus of honking horns directed his attention toward the intersection ahead.

"Must be an accident," thought Gus as he hurried toward the commotion.

As he got closer, he saw that two sedans had locked bumpers diagonally across the intersection and were blocking traffic in four directions. A stocky redhead was standing beside the first car shaking his fist at the driver.

"You lunkhead!" he shouted. "What was the idea of stopping so short? For two cents I'd—"

Just then Officer Pat Stanton strolled up. "Okay, you two. Break it up." He waved the redhead back to his own car. "Get these cars outa here or I'll give you both tickets."

As Gus reached the curb, the door of the first car popped open and out stepped a wiry, bespectacled little old man. In spite of the freezing weather, he wore neither overcoat nor hat. His odd costume consisted of well worn sneakers, a pair of baggy gray pants, a large corduroy jacket, and a plaid wool scarf looped twice around his neck with the ends dangling fore and aft.

Gus Spots an Old Friend

Gus looked at the little man, then at the man's car, and did a double take. It was none other than "Doctor" Jason Evants, the town's best known eccentric and founder of the "Philosophy of Universal Sentiency"—a fad that interested some of the wealthier ladies in the community.

Gus had first run into Doc Evants when the buxom and affluent Mrs. Miller—who had been widowed a year or so ago and had since joined the little "doctor's" group of followers—sent Evants to the Model Garage with Gabriella. Gabriella was his car. Not only did the car bear a name, it could also think and feel—strictly in accordance with the rule of the Philosophy of Universal Sentiency which said that all inanimate things could. At least, that was Doc's story. He insisted "she" had frequently warned him of impending danger by suddenly stopping or refusing to run at all.

Doc Evants Heeds a Warning

"Doctor Evants," called Gus as he walked over to the man. "Having trouble?"

"Ah, Mr. Wilson. Trouble you say." Evants waggled a finger at the redhead. "As you undoubtedly ascertain, this unpleasant individual collided with my car and has interlocked our bumpers."

"Maybe I can help," said Gus. Then he walked over to the second car and climbed up on the front bumper. "Okay," he called, motioning to the redhead. "Put your car in reverse and ease her back slowly."

On the fifth jump, Gus's weight finally jounced the bumper loose and the two cars gratingly parted company. Officer Stanton waved the redhead on his way and Doc Evants climbed back into his car. But instead of turning the corner he straightened out, drove into the through street ahead and parked.

Gus was curious enough to follow.

"Sorry to have been so curt, Mr. Wilson," said Doc Evants, "but I'm afraid that uncouth mental midget unnerved me a bit. Obviously the ebullient type suffering from

"Doctor" Evants graciously opened the door to his car. "Let me give you a lift to your garage and I'll tell you about it."

introversions that can be salved only by expressions of superiority."

"In other words," said Gus with a smile, "a sorehead."

"It could be expressed that way."

Gus Meets Gabriella II

"But what happened to Gabriella?" asked Gus, looking at the car parked at the curb. It was a '41 model in fair shape, while Gabriella, as Gus remembered her, had been a beat-up '35 sedan.

"Ah, Gabriella," sighed Doc Evants. "I finally had to retire her. Old age. She's spending her days out in the yard behind my house. I go out and sit in her every so often. We still understand each other perfectly."

Gus started to point to the car at the curb.

"This, Mr. Wilson, is Gabriella the Second. Thanks to dear Mrs. Miller and a few other friends of my Philosophy of Universal Sentiency I was able to invest in this more modern vehicle a short while ago."

"Does this one warn you the way your first Gabriella did?" asked Gus, suppressing a smile.

"She's beginning to. It was a warning from her that helped cause that slight difficulty at the corner."

"Huh?"

Dr. Evants graciously opened the door to his car. "Let me give you a lift to your garage and I'll tell you about it."

Gus was about to say something about it being his day off, but his curiosity got the better of him and he climbed in with the little old fellow.

Dr. Evants started the car, going through the motions deliberately and slowly. "You see, Mr. Wilson, I was on my way over to see Mrs. Miller about a most important matter. As I was making that left turn from Bank into Main Street, Gabriella II began to sputter and buck as if she were reluctant to go in the direction of Mrs. Miller's house. As if she were trying to warn me."

No Left Turns Allowed

The little man seemed very upset. At that point, he started to make a sharp left turn into Center Street. Sure enough, about halfway through the turn the engine began to miss and falter. The car had enough momentum to make the turn, but Dr. Evants would have none of it. He quickly straightened the car out and continued on ahead. When he did, Gabriella II's engine picked up and ran smoothly again.

"You see, she protested against making that turn."

Gus nodded, but said nothing.

At the next few corners, when Dr. Evants tried to make similar left turns, the same thing happened, and each time he wouldn't complete the turn. As a result, the trip to the garage turned out to be a circuitous tour of the town consisting of right turns only.

By the time they finally made the last right turn into the road that led past the garage, Gus had several ideas about Gabriella's hesitancy.

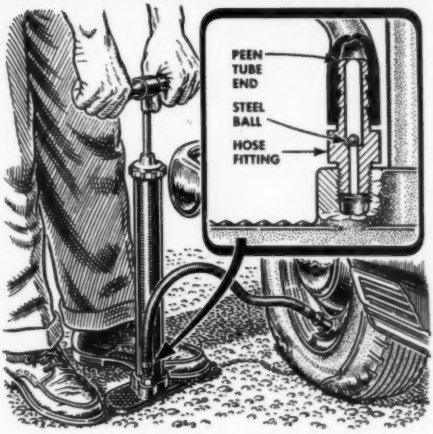
Stan Hicks, the helper at the Model Garage, was busy chipping away ice on the drive when Gus and the doc pulled up. "Hi. What are you doing here?"

"Meet Gabriella II," said Gus with appropriate flourish. "And she has a few of Gabriella I's—shall we say—peculiarities," he added, winking at Stan. "Doctor, why don't you let me check her to see whether she really is trying to warn you not to see Mrs. Miller today or whether it's something else?"

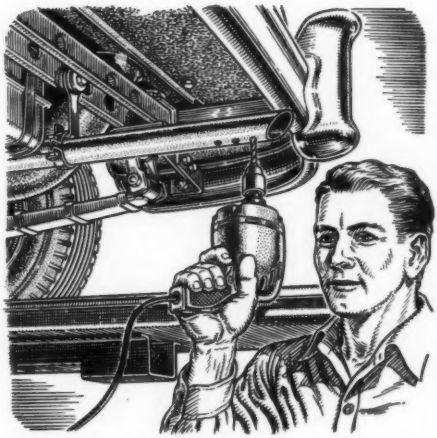
[*Continued on page 226*]

Hints from the Model Garage

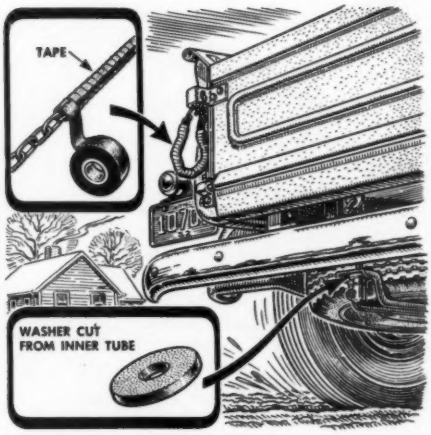
Paint Shows Button Position. From a distance it is sometimes difficult to tell whether car-door lock buttons are up or down. To remedy this, pull them up and paint a white strip around the base. If strip doesn't show, the door is locked.



Ball Check Speeds Tire Pumping. An ordinary tire pump may be hard to use if air leaks back from the tire. David R. Fay of Buffalo overcame this by installing a ball check. The ball used was obtained from an old bicycle-wheel bearing.



Drilled Holes Drain Tailpipe. You can retard corrosion of a tailpipe by drilling three 3/16″ holes 1″ apart at the exhaust end, as shown here. The holes will give condensed water a better chance to drain out of the pipe.

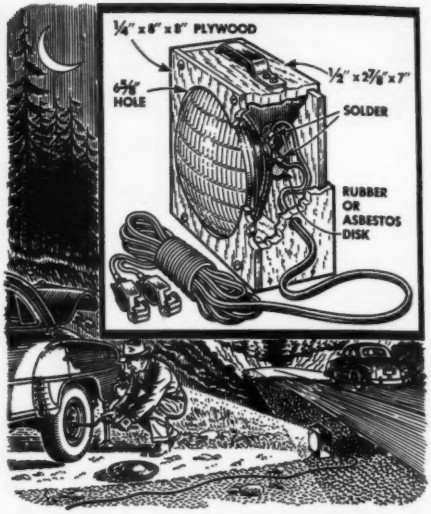


Curbing Truck Noises. Tail-gate chains on a trailer or light truck can be silenced by winding them with tape. If a spare-tire lock like the one shown rattles because of play between the lock and receptacle, insert a rubber washer to take up slack.

Please turn the page for four more auto hints.

MORE Hints from the Model Garage

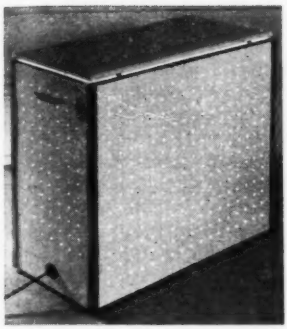
Painting Dash Bulbs Cuts Glare. You may like to try an idea that comes from Jim Larson of Dayton, Iowa. He pulled out all light bulbs on the dash of his '47 Chevvy, dipped them in green paint, dried them under a heat lamp and put them back. This cuts glare when they are on full and produces a new-model lighting effect.



Lamp for Roadside Emergencies. When one beam of a sealed-reflector headlamp goes kaput, pack the unit into a box and carry it for night tire-changing and such. Test the three prongs on the back of the lamp to find which two give light. Solder a 15′ lead to these. Clamp lamp between box front and the rubber disk.

Plastic Bottle Cleans Windows. Refilled with window-cleaning fluid, a flexible-plastic bottle is a handy item to carry in the glove compartment. Empty bottles of this type can sometimes be bought in a drug or dime store.

Calking Protects Eave Trough. If the original calking falls out of the eave-trough joint on your car, replace it with knife-grade compound and paint the compound a matching color. Water will collect in seams left open, causing rust.



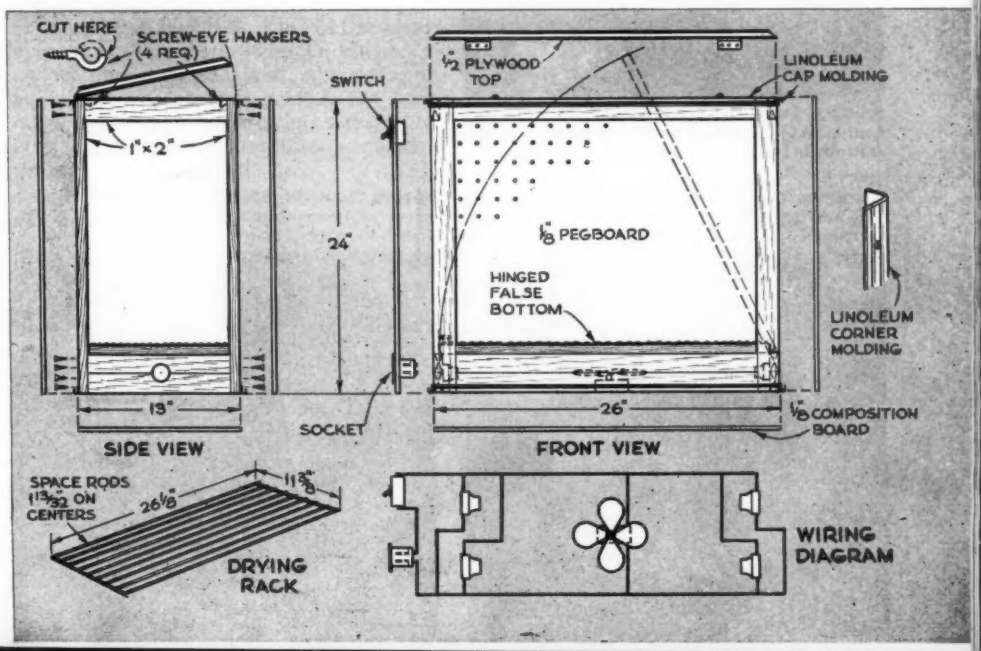
Hamper Dries the Clothes, Too

Four 100-watt bulbs circulate heat through this drier-hamper, which turns out a batch of dry wash in an hour.

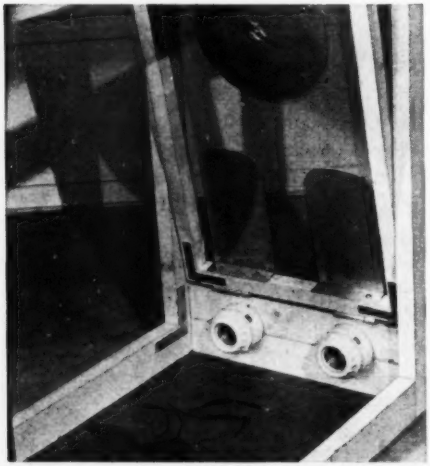
By Carlton Strickland

IT LOOKS like a hamper, holds clothes like a hamper, sits in the bathroom like a hamper, and it is a hamper—but more, too. On those rainy Mondays when other housewives cry about their wet-wash, your wife can finish hers right on schedule. Just roll this box out, plug it in—and it's an electric drier. It was designed to help my wife keep up with baby's demands for "a dry one," but she soon found that it does a swell job on most of the regular wash.

Start with the frame. I found the easiest way to build the frame was to assemble the front and back first and then add



FRAME is made of 1″ by 2″ pine strips. Here front is being joined to back with crosspieces. Lower crosspieces are double strips.



SHIELDS, cut from sheet aluminum, protect bulbs and fan from dripping clothes. False bottom is hinged for access to bulbs and fan.

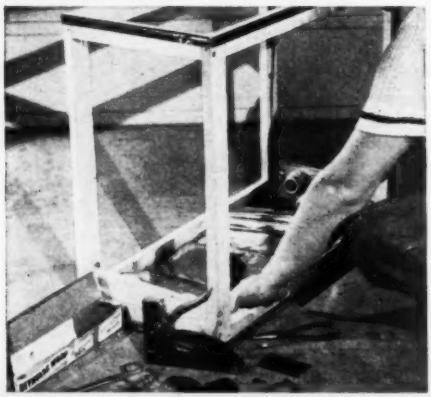
crosspieces to form the sides. The bottom, a piece of ⅜″ composition board, was nailed on and the frame for the false bottom put together. This was made from pine strips 1″ square and joined with flat corner irons to eliminate warping. Galvanized screening was tacked over the false-bottom frame.

Four shields were screwed to the frame of the false bottom to protect the bulbs from drops of water from the wet clothes. The fifth shield, circular in shape, was fastened to the center of the screen with split rivets. This shield also breaks up the breeze from the fan, distributing the heat of the bulbs evenly and preventing the clothes from blowing together and becoming entangled.

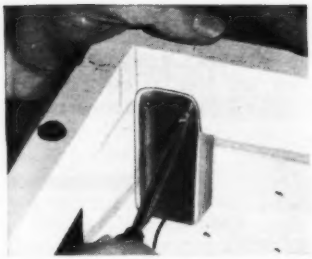
Wired for safety. The fan, sockets and wiring were next installed in a parallel circuit so that each would receive full voltage. I used No. 18 solid thermoplastic wire, obtainable at radio-supply stores, to be sure the insulation would not break down under the drying heat. As a safety measure, the feed wires were separated by running one along the front of the box and the other along the rear. The fan was temporarily set in place and its leads soldered to the feed wires. All wire joints were taped with plastic electrical tape, which will withstand high temperatures without breaking down. Any small household fan that will operate in a vertical position will serve. Check on this, as some fans should only be used horizontally.

The switch and plug connection were wired in at this time, to be permanently installed when the sides of the drier were set in place. I used a switch rated for 10 amperes at 125 volts. It should be mounted in a suitable outlet box or covered in some way to protect the terminal screws from contact with wet clothing. I terminated the wiring in a recessed plug connection, eliminating a permanent cord and making it possible to

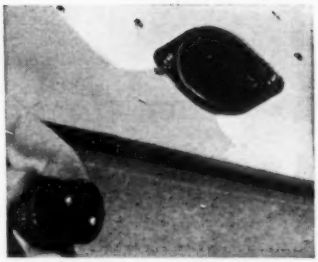
LINOLEUM CAP MOLDING is nailed all around top and bottom of frame to receive panels. Bottom is lined with aluminum foil.



FAN IS CUSHION-MOUNTED on rubber tape or piece of inner tube after foil is in place. Notice how wires separate to front and rear.



COVER TERMINALS of the switch to prevent accidental contact with hands or wet clothes. Metal cover is lined with electrical tape.



RECESSED OUTLET connects wiring to extension cord, which may be removed and stored beneath false bottom of drier.

use an ordinary extension cord to connect the drier to the house circuit. The extension may be stored beneath the false bottom when not needed.

After the wiring was completed, I covered the floor with aluminum foil and bolted the fan down for keeps on a cushion mount, cut from an inner tube.

Pegboard. The sides, front and back of the drier were made of ⅛″ perforated composition board, called "pegboard." It is much used in the window-dressing trade and, though it is slightly more expensive than plain panel, it sure is worth the extra dimes to save all that drilling. To hold the sides, front and back in place, strips of linoleum cap molding were nailed all around the frame, both top and bottom. Then the panels were sprung in place by bowing them out to insert them in the molding. The corners were finished off with linoleum corner molding.

You'll find the job a whole lot easier if you prime and paint the panels before you install them. If possible, spray the paint on to avoid filling the perforations. Use white on the inside for maximum heat reflection. Don't paint below the underside of the false bottom, as heat from the bulbs may cause blistering.

Cover. Plywood, ½″ thick, was used for the cover of the drier. The edges may be rounded off by sanding, or they may be covered by nailing molding strip or beading all around. Two rubber-headed nails were set on the upper front rail of the frame to balance the thickness of the hinges, which should not be set in either frame or cover. This leaves an air space at the top.

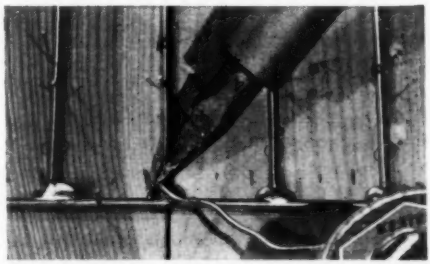
The drying rack was constructed of welding rods, soldered together. Steel rod ⅛″ in diameter will do as well. The pieces were cut to length, laid out and tacked to a flat surface. Solder was applied liberally on each joint and excess later taken off with an electric hand grinder; a round file can be used. Four screw eyes, cut to form hooks, support the drier rack, which is hung on the two rear hooks when not in use.

A rack may be made of ⅜″ dowels set in 1″ by 1″ endpieces, but it will be rather cumbersome in such a small space.

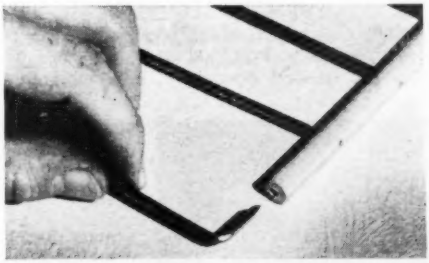
Small ball casters were hammered into the four bottom corners and chrome handles were fitted to the sides to dress the job up a bit.

A fast bulb-snatching tour rounded up four 100-watt bulbs and the drier was officially open for business.

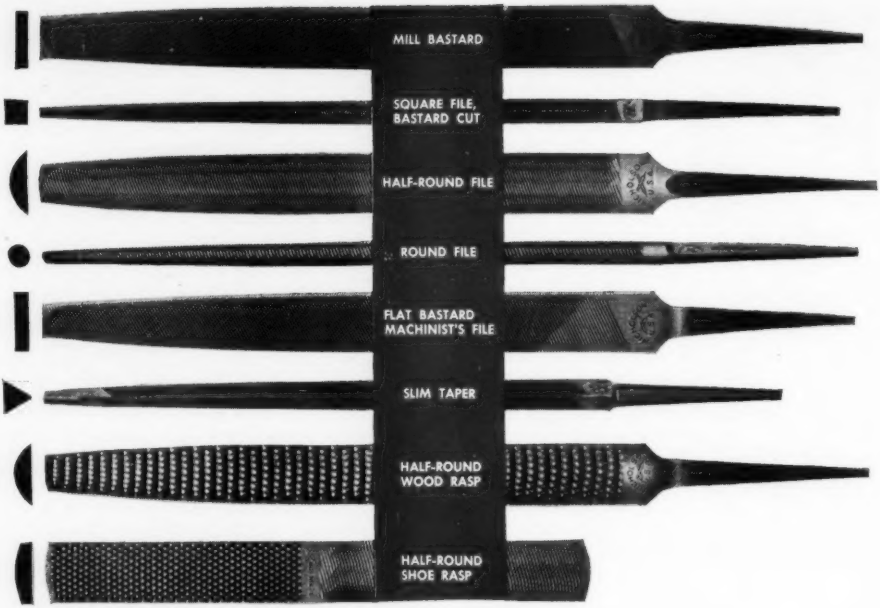
You'll find, when using the drier, that drying time will vary from 45 minutes to two hours depending upon the humidity. END



DRYING RACK is assembled from welding rods or ⅛″ steel rods. Lay out and tack them in position prior to soldering, as above.



ALTERNATIVE METHOD of constructing drying rack uses steel rods forced into undersize holes in two dowel endpieces.



Get Acquainted with Files

Out of hundreds that exist, do you know which is right for your job? Here's how to choose, use and care for them.

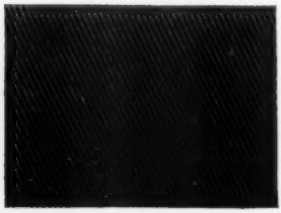
By Steve Mashek

EVER since some cave man found that he could sharpen a stone by rubbing it with a harder one, we've been using and improving his technique. Metal, it was found, could be worked with harder metals, and eventually teeth were added to make the tool work faster.

Hundreds of types, shapes and sizes of files are needed nowadays. Few workmen need to become familiar with all of these varieties, but everyone who uses tools should be well acquainted with the most common kinds.

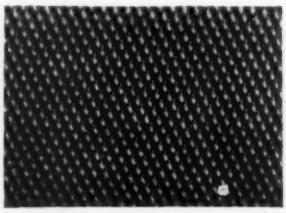
Looks are deceiving. At first glance, these industrial back scratchers seem to be all alike, except for their shape. The big difference, though, is in the cut. Some are *double-cut*, others *single-cut*. Degree of coarseness is listed in order: rough, coarse, bastard, second-cut (not to be confused with double-cut), smooth and dead-smooth.

Names tell the story. File names usually indicate the type of cut. *Machinist's files*, which head the list as all-around, fast-work-



SINGLE-CUT. One series of diagonal cuts (left) forms long teeth that work with shearing action. Smooth but slow.

DOUBLE-CUT. Two series of opposing diagonal cuts (right) form diamond pattern of thousands of pointed teeth. Fast working but rougher.



ing tools, are double-cut. They are ordered by name, shape and length. For example: to buy a flat file for fast cutting without regard for finish, you should ask for a 10″ flat *bastard machinist's file*. The length is the actual body of the file, not including the tang or narrow portion that is fitted with a handle.

Common machinist's-file shapes are:

- Flat file; has teeth on both sides and edges; tapers slightly in width and thickness.
- Hand file; often used for finishing, is similar to flat file, but has one safe or uncut edge.
- Round file; used for circular openings and curved surfaces.
- Half-round file; saves changing files when working on irregular surfaces.
- Square file; used for slots, keyways and surfaces. These are tapered, but do not come to a point.
- Three-square file; triangular in shape, it gets into internal angles and sharp corners.
- Knife file; resembles a knife blade, permits working in acute angles.
- Warding file; tapers to a point in width, but is uniform in thickness. Well suited for filing in narrow spaces.

Mill files, designed to sharpen saws and cutting tools, are useful for lathe work, drawfiling and all work requiring a smooth finish. Mill files are single-cut and work slower but much smoother than machinist's files. The usual shop mill file is flat, tapering in width. The saw sharpeners are the tapered, slim-tapered, and blunt triangular files. Another is the round-edge *cross-cut file,* which is used to deepen the gullets between circular-saw teeth.

Wood files have teeth that are similar to those of machinist's files but are much coarser and differ sharply from the wood rasps. Rasp teeth, unlike those of files, are individually formed and not connected. The coarsest, made in flat, half-round and round shapes, is the *wood rasp,* used by wheelwrights, woodworkers and plumbers. Too coarse for the typical home job, it is often purchased by the man who really wants the smoother-working *cabinet rasp.* Even smoother in its cutting action is the *patternmaker's rasp,* made only in half-round.

GOOD BEGINNING for a collection of files: In rack (left to right)—10″ flat bastard, 10″ mill bastard, 6″ slim taper, 8″ round bastard. On bench—8″ half-round shoe rasp and set of 5½″ Swiss pattern files. Notched board is fastened to wall for convenient rack.

The *horse rasp,* also much too coarse for the home shop, has a milder counterpart in the *shoe rasp,* a combination rasp and file made double-ended in half-round and flat section.

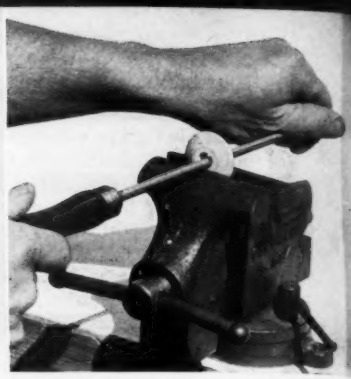
Curved-tooth files are somewhat specialized for home use unless you do your own automobile-fender work. The curved teeth readily clear themselves of chips, a necessary feature on soft material. Rigid ones come with or without tangs, and there are flexible types, with a hole in each end, for use in a special holder that bends them to any reasonable radius for working in

DON'T HAMMER a file into a handle. Push tang in and rap handle smartly on bench (left) until file seats itself securely.

CLEAN FILES will cut faster and leave no scratches. File brush (right) does job.

NICKS ARE REMOVED from ax with 10″ flat bastard machinist's file, as this job calls for taking off quite a bit of metal with little regard for the finish of the work.

GENERAL SHARPENING and finishing are done by mill bastard. Use it to renew edge on garden tools and mower blades and to finish work requiring smooth surface.



ENLARGE A HOLE or fit a door lock with the round file. It is particularly useful for filing concave surfaces and for profiling — filing irregular shapes on edges of work.

concave areas. Shapes are flat, half-oval and half-round.

Swiss pattern files are made in a great variety of accurately formed shapes in very fine cuts. They are most often used in smaller sizes for delicate work.

Special-purpose files are numerous but seldom needed in the home shop. It doesn't hurt a bit, however, to know that they exist. There are *foundry files,* for cleaning up rough castings, *die-cast files* for removing flashing or sharp corners on die castings, and double-end files, called *rifflers,* with pointed ends shaped in a wide assortment of curves for use by die sinkers and silversmiths.

Other files, made for specific materials, carry inscriptions such as "for stainless steel" stamped on their tangs.

Use files properly. If you've learned to select the right file, half the battle is won. The other half is learning to use it properly. Most work is best done at about elbow height, clamped in a good vise.

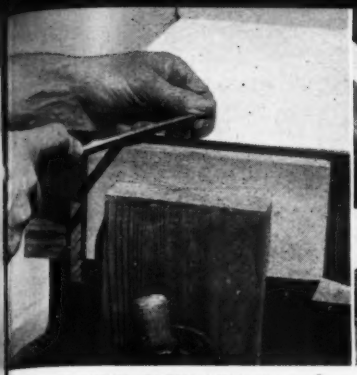
Beginners naturally rock a file across the work seesaw fashion. But to obtain a level surface, the file must be pushed forward in as close to a horizontal plane as possible. Push just hard enough to keep the file cutting all the time. Too much pressure is likely to chip or clog the teeth of the file. Too little will allow the file to slide over the metal, dulling the teeth rapidly. It is good practice to lift the file clear of the work on the return stroke. The exception to this rule is *drawfiling,* a method of pushing and pulling the file sideways across the work to produce a fine finish. A single-cut file is best suited for this work

Lathe filing is another smoothing process in which the file is stroked against work revolving in the lathe. The flat mill is quite capable of handling most lathe-filing jobs, but there is a special *long-angle lathe file* with teeth cut on a longer diagonal than those on the mill file. This longer angle produces a clean, shearing cut and reduces clogging. A light touch with a long-angle lathe file brings the work to maximum smoothness. Both edges of this file are safe, permitting you to file right up to shoulders on the work.

Files require very little attention compared with other cutting tools. To make your files safer and easier to use, handles should be fitted to the tangs. A rack will keep files handy and prevent dulling from contact with other files. Files carried in a car or tool chest should be protected by individual wrappers of cloth or paper.

Clean files often. A clean file cuts faster and leaves no scratches. Rub a file brush or card across the file for general cleaning. Use a pointed scorer for picking out the stubborn chips. You can buy a file cleaner combining all three types. Oddly enough, both rust and grease are enemies of the file. Rust eats the teeth away, rendering them useless, and grease encourages clogging. To avoid rust, keep the files clean and store them in a dry place. To remove grease and oil, rub the files with chalk and go over them with a brush. These small efforts are well repaid in better work more easily done with tools that really cut. END

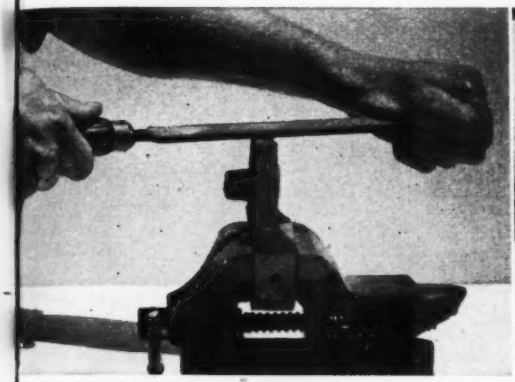
Engraving jewelry interest you? See PS next month and learn to cut a monogram.



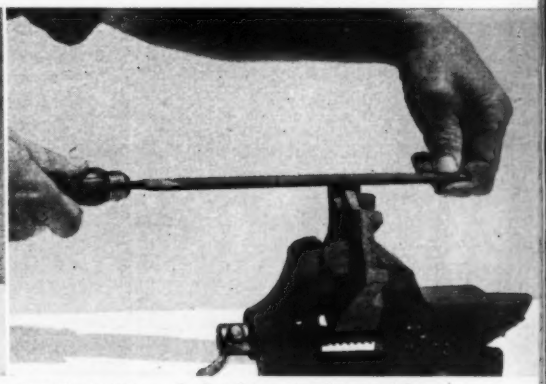
A SLIM TAPER FILE at work sharpening a saw. Two blocks of wood are used in a bench vise to clamp the saw in the absence of a special saw vise.

WOOD PARTS are quickly shaped with the half-round shoe rasp. A wood rasp or cabinet rasp is excellent for finishing wood joints, particularly on end grain.

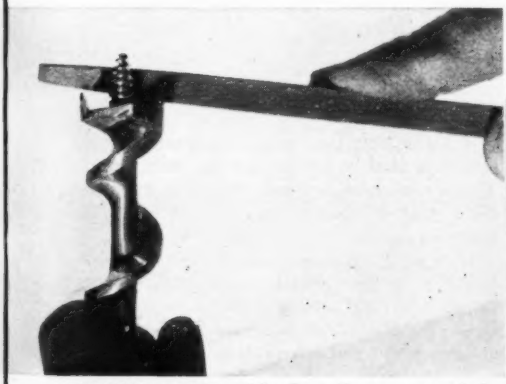
SWISS PATTERN FILES, made in a wide variety of accurately formed shapes, are ideal for model and die work. They are favorite tool of instrument makers.



HERE'S A GOOD GRIP for heavy filing. Have work at elbow height and stand erect to avoid rocking-horse strokes.



LIGHT FILING and finishing is done with a sensitive, two-finger grip on the end of the file. Lift file on return stroke.



ONE-HAND GRIP, with first finger extended for control, is best for sharpening tools not held in a vise. Choice for this job is auger-bit file made for the purpose.

DRAWFILING, done with a mill bastard, is the way to a finer finish. The two-hand grip, with thumbs behind the file, guides it back and forth over the work.

Get More Out of Basement Shelves

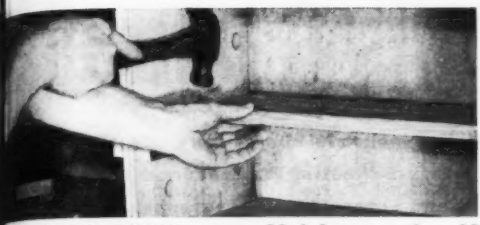
How to remodel that preserve closet to get greater usable area and more working convenience.

By Paul Corey

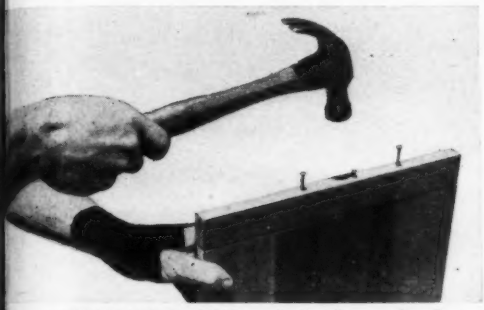
WHEN you have wanted to take something from the back of a crowded shelf, you've probably wished for an extra hand. That's why I built a helping hand right on each pair of shelves when I added shelf space in our utility-room storage cabinet.

Instead of vertical doors, I built horizontal doors on the cabinet. They are hinged to drop down and are held flat—like an open hand—by chains, giving you space to put articles while you select an armful from the shelf.

Getting more space meant adding intermediate shelves between the widely spaced shelves already there.

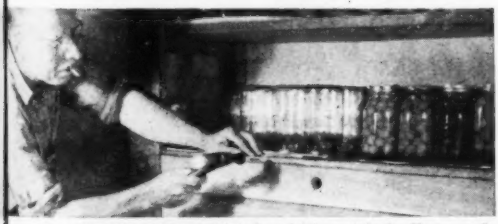


NEW SHELVES were added between the old ones, doubling the usable space. Holes were bored in side walls to improve air circulation.



STRIPS WERE NAILED and glued to ends of vertical doors to keep doors from warping. The reinforcing strips measured 1″ by 1½″.

TWO LENGTHS of sash chain were fastened by screw eyes to hold doors flat when open. Chains run from shelf to inside of door.



WOOD STRIPS ¾″ by ¾″—with bullet-catch cups on bottom and hinge mortises on top—were nailed to every other shelf.

Cupolas Are His Business

CUPOLAS to perch on roofs are the product of Frank Smith's woodworking shop in Independence, Ohio. Built mostly of wood, they are topped with composition roofing or copper. Surmounting the cupolas are weathervanes and compass points jigsawed from hard composition board.

Smith works from house blueprints where possible, and often incorporates the homeowner's notions about decoration. Besides breaking up monotonous roof lines, the cupolas are useful to hide vent pipes or roof ventilators. Smith sometimes lines the purely decorative jobs with paneling to keep birds from nesting behind the louvers.

While proportions should suit the building, Smith says that for a small home or two-car garage, these dimensions are about right: 30″ square at the base, 21″ square at the louvered section, and 36″ high, not including the weathervane.

Cleaning Stained Sinks

You can remove those stubborn rust stains from your enameled sink by treating them with acid. Vinegar or lemon juice sometimes does the trick, but dilute hydrochloric acid (muriatic acid) available from drugstores, is more effective.

Bleaching solutions, such as Javelle water or Clorox, will often remove light stains that do not yield to the abrasive household cleaners.

His Camera

Drama-packed industrial shots have made fast-moving, fast-shooting Robert Yarnall Richie a famous—and expensive—photographer.

By Ralph Steiner

Earns Over $500 a Day

IF YOU were president of a 10-million-dollar corporation and you wanted some good photographs taken of your plant, the name of Robert Yarnall Richie would probably come most naturally to mind. It might cost you as little as $500 a day or as much as $1,500 to get him behind his camera for a few hours. Still, no frown would cross your brow at the thought of his charges: Richie and his pictures would be worth every cent they cost you.

In the first place, you'd balance against his generous fees the fact that he shoots two to three times as fast as most of his rivals. You'd get more pictures for your money. Count two, he shoots so fast he doesn't hold up your production line. So if your firm happened to make Cadillacs, you'd end up with one or two more Cadillacs at 5:30 than you would with a slower photographer who gummed up production while shooting. Count three, Richie's preparation for making a photograph often far outweighs the time and effort he spends behind his camera. Recently he flew his private plane from Charleston, S. C., to Palm Beach, Fla., looking for just the right lighthouse as background for a picture of a new automobile—which he later shot in an hour.

RICHIE TURNED STAGE MANAGER to set up this picture in General Motors' locomotive shop. He talked the foreman into turning the locomotive around so its front would show. An arc welder was spotted in front solely for drama. He wasn't really working. The bright rails and parts in right foreground were placed there to help the composition.

Got Start During Depression

What makes Richie a magic-money photographer? Not any trick camera or lens; many a three-buck-a-shot photographer uses the same equipment. It's the quality and quantity of his thyroid juices. They jet-propel him. He hardly ever stops whooshing, from British Columbia to Texas to New York to Saudi Arabia. I tried for three

A COLD WINTER MORNING was picked as best time for railroad scene below. Early light highlighted steam, cold made it cottony.

months to get him to light long enough to be interviewed for this story.

Richie's career began in the depression. Richie was 22, with a new pilot's license and no time to notice a little thing like a depression. A real-estate agent needed an air shot of an estate to interest a buyer, and Fairchild Aerial Surveys wanted more than he could afford, so the agent asked Richie to shoot it. Richie knew planes but not cameras. With more thyroid than know-how he zoomed into action and into a high-income-bracket career.

First Attempt Fails

He rented a plane for the next morning. Then off he went to Fairchild to rent a camera. Fairchild didn't rent cameras. Richie talked big about buying a camera if he liked it. Fairchild gladly lent him a camera. Richie knew nothing of camera weather, filters, camera angles, shutter speeds; but he couldn't appear inexperienced in front of Fairchild by asking questions.

Next day the weather was dirty, but Richie figured if he could see to fly he could photograph. Dimly he saw the estate in the finder; dumbly but happily he snapped away. The gray, ghostly prints that came back from the laboratory would have been

Advice from an Expert

Richie's advice to amateurs taking industrial pictures:

"If you haven't the equipment for indoor shooting, keep your eyes open early and late outdoors for unusual lighting that costs you nothing. Indoors, eliminate everything extraneous—simplify. Throw light only where you need it. Keep backgrounds neat or keep them dark. Shine all metal surfaces."

For pros: "I love my job; if you work for money only, you can't do a good job."

A LOVE OF SPOTLIGHTING makes everything in a Richie picture zing out loud. In this case he turned two spots on technician, then directed five others to shoot into TV tubes and reflect into lens.

more help to a spiritualist than a realtor.

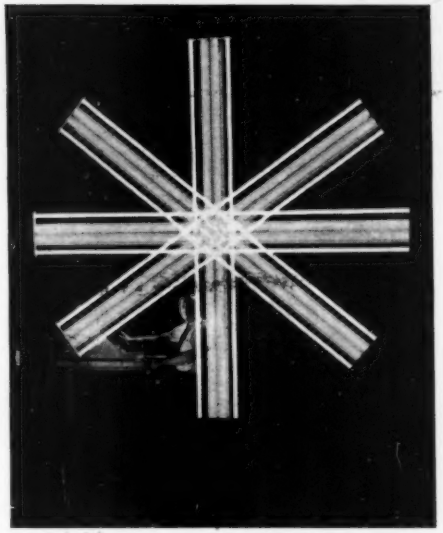
Somehow he wangled a camera from Fairchild once again. Smarter now, he waited for a clear day. And because rental of the plane for a second day would wipe out his profit, Richie shot not only the estate he'd fogged before but several others and a private school—"on spec." He sold every picture, made a profit and was deep in the photographic business.

Pictures Sell Clothes

He showed Rogers Peet, the clothiers, his shots of the private school and sold them on the idea of taking others for a back-to-school window display. Then they wanted a series shot from the ground: football, yacht racing, golf tournaments, trotting races. Richie developed the jitters because his technique was below zero.

Walking the streets of New York at

[*Continued on page 228*]

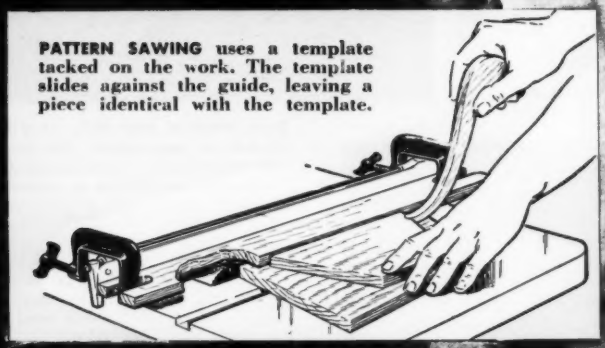


DULL PHOTOS ARE OUT, where Richie is concerned. His assignment here was to shoot a technician watching a meter that measures light given out by a fluorescent tube. First he photographed technician and tube. Then, discovering the tube could be inclined at any angle, he shot the tube three times more in different positions on the same film.

DRAMATIC LIGHTING of this night shot of a trainload of red-hot ingots going to the soaking pits was easy once Richie had gotten the idea. A flash bulb illuminated the man, a one-second exposure recorded light from ingots.

A SUCCESSFUL AFTERTHOUGHT. Winding up a day's shooting in the Texas oil fields, Richie got the idea for this picture after his assistants had gone off with his lighting equipment. Undaunted, he turned the headlamps of two cars on the truck and asked the driver to turn his spotlight into the cab and shine it on himself. The driver held still and cut the truck headlamps halfway through a six-second exposure. The client hadn't asked for this shot, but used it more than any ordered.

How to Use Patterns with Power Tools



PATTERN SAWING uses a template tacked on the work. The template slides against the guide, leaving a piece identical with the template.

Jigs and patterns speed repeat shop work. They also let you turn out jobs that can't be done in any other way.

By Edwin M. Love

"AT IT again, I see."

Chet Thompson switched off the saw and looked up at his visitor. "Hi, Sid. Yes, I'm at it again."

Sid Howell picked up a small board with sloping ends. "How many do you have to make?"

"Never mind the 'you' business," Chet told him with a grin. "You're in this, too."

Chet Thompson was a sound craftsman. His wife was president of the Ladies Auxiliary. For those two reasons he had been elected to turn out souvenirs for the Auxiliary's state convention. The souvenirs were shaped pieces of ¾" stock. After Chet and Sid turned out the blanks, the ladies would burn their organization's motto on them with electric burning irons.

Just Bang 'Em Out

"I know I'm in it," Sid chuckled. "My wife just gave me the word. But you'll have to brief me. I'm still in the ox-cart era with my shop."

Chet laughed. "Nothin' to it when you've set up a jig. Just bang 'em out."

Sid pointed at a notched strip of wood that was clamped to the fence of the table saw. "Is that the jig?"

"Part of it. That's the guide that the template slides against." The guide was clamped to the fence about an inch above the table to give clearance for the ¾" stock to slide under it.

"Go ahead and make one," Sid said.

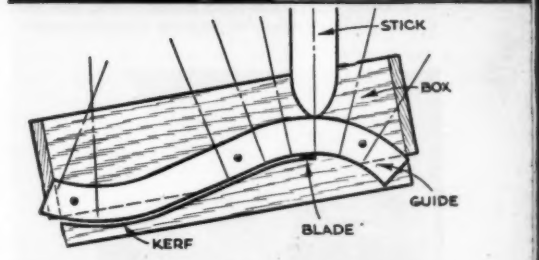
Patterns Can Be Fancy, Too

Chet picked up the template and tacked it down on a piece of ¾" stock. He snapped the switch and made four quick passes, sliding the edges of the template against the guide. The blade lopped off the projecting edges of the work, leaving a trimmed piece identical with the pattern. Chet pried it off and handed it to Sid.

"There's a souvenir," he said.

"I can see now how we can turn them out so fast," Sid said. "That pattern stunt is all right. But suppose the women wanted some fancy work—and I'm surprised they don't—along one edge?"

"An irregular curve, for instance?"



CUTTING A STACK on a bandsaw. The curved pattern rides against the bluntly pointed guide stick, causing the bandsaw blade to cut the same curve in the stack of plywood blanks.

"Yeah," Sid said. "Just suppose, but let's not suggest it."

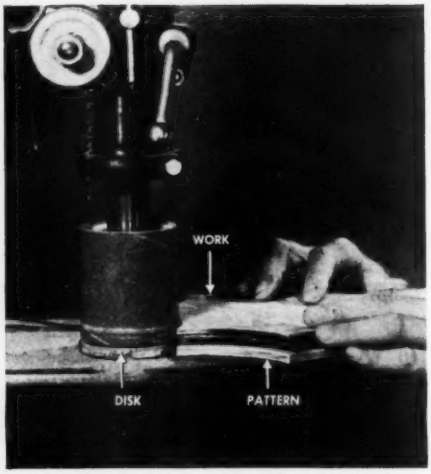
"Take a look at this," Chet said. He pulled a dusty jig from a shelf under his workbench. "This is a mass-production gimmick I made when I was thinking about going into war work."

It was a box, open on one side, that held a stack of plywood blanks. A guide bar that had been bandsawed to the curve that was wanted was nailed on top of the box.

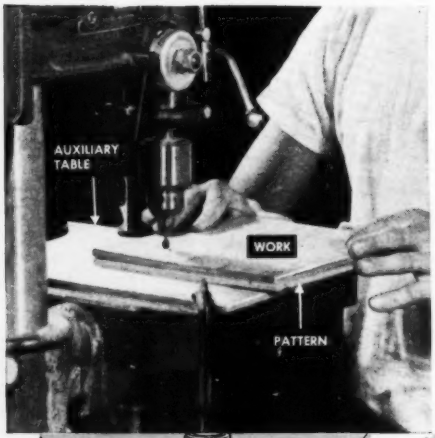
Cutting a Stack at a Time

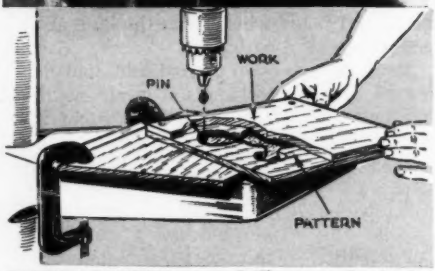
"How does it work?" Sid wanted to know.

"Like this." Chet blocked up a bluntly pointed stick so the point bore against the curved guide bar. Then he clamped block and stick to the bandsaw table. "The point of the stick has to be opposite the teeth," Chet explained.



SANDING ON A DRILL PRESS. Wood disk, same size as sanding drum, is bolted to table. Pattern rides against this to guide work against drum. Shim work and pattern slightly apart.





PATTERN ROUTING on a drill press. A pin in the auxiliary table directly under the router bit follows the pattern and bit duplicates pattern in the work on top.

He switched on the saw and began to feed the plywood blanks into the blade, pressing the curved guide bar against the pointed stick.

"Cuts the whole stack in one pass," Sid commented.

"Right. Only thing is, you can't feed these as fast as you could a single thickness. And don't rock the jig on its base. It's a good idea to use as wide a blade as possible."

"Seems to me you could manage pattern sanding, too."

Intricate Sanding Made Easy

"That's right," Chet agreed. "The drill press is a natural. You can step it down to about 1,200 r.p.m.—a good speed for a 2½" drum—and there's plenty of vertical adjustment."

Chet stepped to his workbench and picked up a piece of plywood that had scalloped edges. A scalloped pattern, with a shim sandwiched between, was tacked to the work.

"Here's a job I was working on when the souvenirs interrupted," Chet explained. He walked to his drill press. "Notice this disk bolted to the table under the drum." He switched on the drill press.

"I get it," Sid said. "The pattern bears against the disk and guides the work against the sanding drum perfectly."

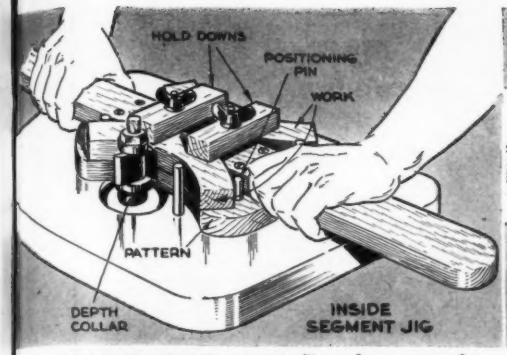
"While we're at the drill press," Chet said, "let's have a little fun with pattern routing." He clamped a plywood auxiliary table to the drill-press table and chucked a router bit.

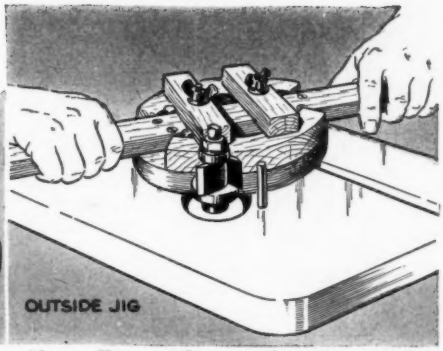
"See this pin in the auxiliary table?" Chet pointed. "It's the same diameter as the bit and centered exactly under it." He tacked a plywood cut out to the underside of a square of plywood and placed the cut out over the pin. Then he lowered the bit and locked the quill.

Invisible "Finger" Follows Template

"If you ran the bit down through the work," Sid said, "it would cut out the entire inside like the pattern. Seems to me that would be just about the same as jigsawing."

"It would. For pattern routing you just lower the bit to the depth you want. Then you slide the template counterclockwise with the template edge bearing against the pin. After you've routed the outline, clear out the inside waste."





SHAPING CURVED PIECES. Jigs above, one for inside curves and one for outside, are faster than sanding for production runs. Pattern rides collar, guiding work against cutter. Pins in pattern position work. Pieces should first be bandsawed to rough shape.

"What do you use for a pin? Dowel?"

"Yes. If I were going to do a lot of this work, I'd bore the auxiliary table for dowels shouldered down to match the various diameters of my router bits."

"I see," said Sid. "Then you could change pins just about as fast as you changed bits."

"That's the idea."

Sid reached into the scrapbox and picked up a curved piece of wood. It was about 1″ square and 6″ long. It looked like an arc of a circle.

"Suppose," Sid asked, "you wanted to smooth the inside and outside of this curve. What would you do? Sand them?"

"Yes, if I only had one piece like that to finish. If I had a lot to do, I'd build a combination template and holding jig and do them on the shaper."

Jig Does Two Jobs in One

Chet picked up another piece of scrap and bandsawed a template. One side of it fitted the inside curve; the other the outside curve. "For a really long run," he said, "I'd make two templates—one for the outside curve, the other for the inside."

"But how would you clamp the work to those patterns?" Sid asked.

"A pair of cross yokes with bolts and wing nuts will do it," Chet explained. "A pair of pins will position them. After you smooth one edge of each, interchange them. It might also be a good idea to screw handles to the pattern—for safety."

Suddenly the cellar door opened. "Chet?" called a woman's voice. "I'm back from the Auxiliary meeting."

"How'd they like the sample souvenir?"

"We-ll. We were wondering. . . Couldn't you make them just a wee bit fancier—put some nice scallops or something on them?"

Chet and Sid just stared.

"It shouldn't be hard," said the voice from the stairs. "You men are so clever with those tools. Besides, we made it easy for you."

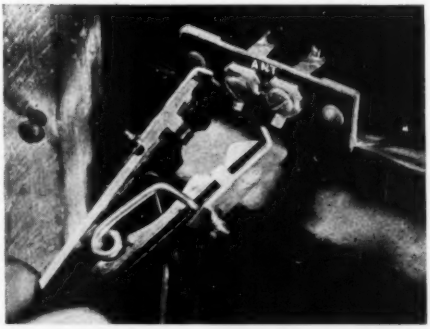
"You did?" asked Chet.

"Of course, dear. I overheard you tell how you use patterns to cut out the wood. Well, Madge had some wrapping paper, and. . ."

"You didn't!" groaned Chet.

"Yes, dear, wasn't that nice? We cut you out the loveliest paper patterns. Now all you have to do is go ahead and saw." END

"Clothespin" Clips TV Antenna

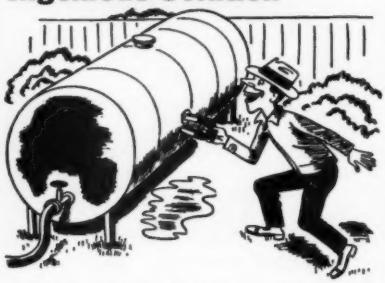


LOOKING like an ordinary spring-type clothespin, this plastic connector has metal tips that quickly clip to TV antenna terminals. The "Tenna-Clip" is made by Industrial Television, Clifton, N. J., for showrooms and service shops where one lead-in is moved from set to set.

Dressing Restores Car Top

APPLIED with a roller, a new convertible-top dressing gives an improved appearance to the fabric and restores its original water-repellency. Available in clear, tan or black, the dressing has a plastic resinous base that penetrates the fibers. A fungicide is included to retard mildew and dry rot. Champion Textile Finishing Co., Chicago, is the maker. Dressing kit includes a roller and pan.

My Most Ingenious Solution



A 200-gallon oil drum sprang a small leak. When I saw my liquid assets dripping away, I knew something had to be done fast. I also knew what to do.

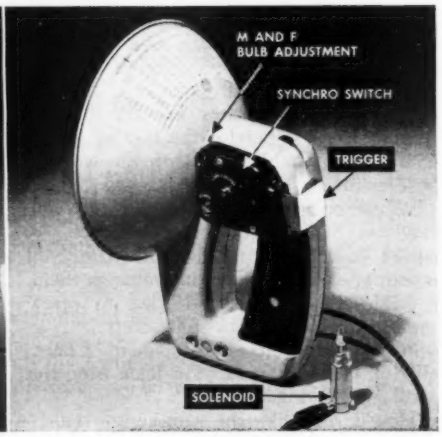
I hustled to my workshop and scouted up a strong horseshoe magnet and a thin slice of neoprene. I put the neoprene over the hole and covered it with one pole of the magnet to hold it on.—James B. Giern, Romeo, Mich.

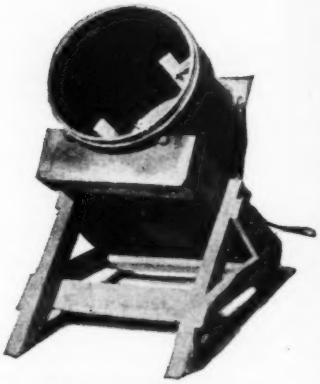
New Flash Gun Has Pistol Grip for Off-the-Camera Shots

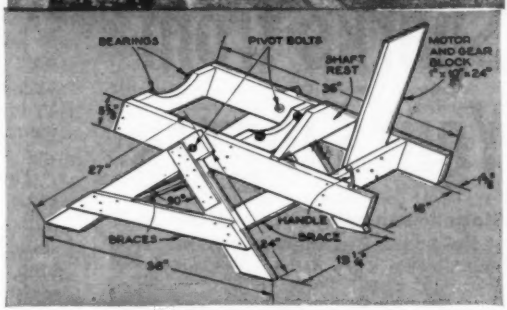
A PISTOL grip improves your aim when you shoot flash pictures with this new flash gun. A thumb button on the rear of the grip triggers the gun if it is used with a shutter having built-in synchronization. An L-shaped lever depresses the button when a synchro switch is attached for shutters using a solenoid tripper.

Made by Eastman Kodak, the gun has space inside for one or two miniature 22½-volt batteries and condensers. With two batteries, the gun will fire as many as seven extension lamps. Extension holders are also made with a pistol grip.

Exposure information for different types of bulbs is printed on the back of each reflector. A special bracket attaches the gun to the camera for easy carrying.







Washer Gears Drive Little Concrete Mixer

COMBINING the twin advantages of portability and low cost, this mixer is ideal for home concrete jobs.

The major parts are short lengths of lumber, a 30-gal. metal drum, a ½-hp. motor and a gear unit from an old washing-machine wringer.

The stand is a pair of A-shaped frames made of two-by-fours and braced with one-by-fours, as shown in the drawing. The cradle in which the drum revolves is built of two-by-sixes screwed together.

Two of the two-by-six crosspieces are cut out to take the drum. Roller-skate wheels, on which the drum rides, are secured to these crosspieces.

Darryl Kraft of Chicago, who built this mixer, used a gear unit from an old Conlon washer. Any similar unit will serve. One end of the gear unit is centered on the bottom of the drum and bolted in place. The other end of the unit is bolted to the cradle.

To help agitate the mix, an angle iron is bolted across the bottom of the drum and two pieces of one-by-two are bolted diagonally on opposite sides of the drum.—*Bert Goldrath, Chicago.*

Motor-Driven "Shovel" Throws Snow 20 Feet

CLEARING drives and walks is easy with this push-button snow shovel. Its rotor blades will throw snow up to 20′, and its ½-hp. motor has a reversing switch that changes the direction of throw. The snow remover rides on semi-pneumatic tires, has a handle that adjusts for height, and is equipped with 100′ of cord. It operates on 115 volts. The Electric Snow-Blo is made by Sensation Mower, Inc., Ralston, Neb.

STATIC IS A HAZARD in the presence of a flammable liquid or vapor. The sparks can cause a fire when you dip or rinse clothing in gasoline or volatile cleaning fluid. Sparks produced by combing hair have ignited shampoos.

You can demonstrate this danger. Have a friend stand on inverted glass jars to insulate him from the ground. Give him a metal spoon and rub the back of his jacket briskly with a vinyl-plastic phonograph record. Then have him hold the spoon near a few drops of carbon disulphide in a metal bottle cap supported on an upturned cake tin. A spark will jump to cap, firing the fluid. *(Caution: keep open bottle away from flame.)*

Sparks from Your Fingers

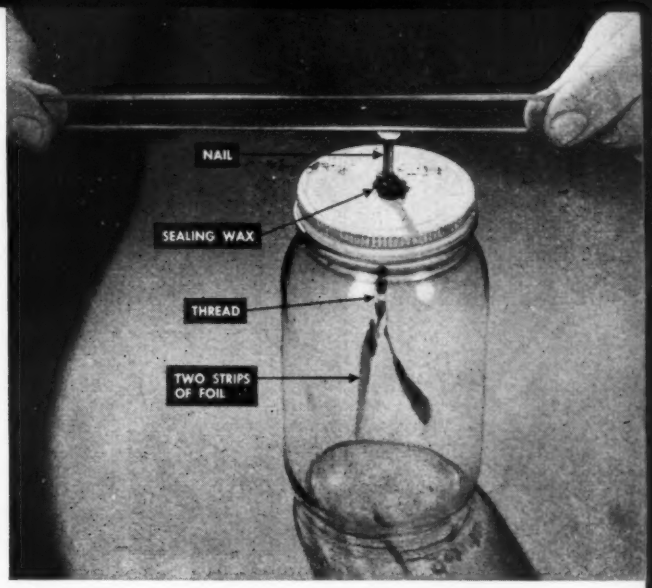
Static is annoying at this time of the year. But these experiments put it to work for an evening's fun.

By Kenneth M. Swezey

ANY way you look at it, static electricity is a nuisance. It causes unwelcome dust to hug your phonograph records. Its snapping spark makes you jump if you touch metal while riding on plastic seat covers. It brings crackles from your radio. And, worst of all, it can touch off a fire or explosion if conditions are right.

This is the favorite time of the year for static to play its pranks. In January, low indoor humidity leaves surfaces dry, and static charges build up. In June weather, high humidity spreads a film of conductive moisture, draining away the static as fast as it forms.

MOISTURE ELIMINATES STATIC. With a vinyl record and scraps of tissue paper you can prove it. Rub record with wool cloth and hold it near paper scraps. They will jump to record (left). Then remove paper and blow your moist breath over surface of record (center). Now rub record with wool cloth again and try to pick up the paper. You'll find you can't (right). This time the static has drained away through your hand.



WHY TIRES MAKE STATIC. While you drive, tires and tubes are constantly flexing. This stretching and contracting of rubber charges it with static. One result may be crackles in your car radio. The mere making and breaking of contact between tires and road also build up a charge. An electroscope like this one will show how rubber produces static. After stretching a rubber band, draw it across the electroscope knob. The farther you draw it, the farther the tin-foil leaves will spread apart. Next discharge the stretched band by drawing it across a grounded pipe. Let band contract, and draw it again over knob. Leaves will come together. Contraction also charges band, but charge has opposite polarity.

If you understand static, you'll have a better chance of forestalling its tricks. Here is a series of experiments to show you what it's up to.

What is static? It usually is the result of separating two substances that have been in close contact—a comb from your hair, a belt from a pulley. While the objects are in contact, free electrons pass from one to the other. After they are separated, the object that has lost electrons carries a positive electric charge, the other a negative charge.

If the object is a good conductor, the charge leaks off to the ground as fast as it forms. If the object is an insulator, the charge may attain an amazing value. When you comb your hair on a dry day, the potential behind the crackle may reach 10,000 volts. Your car may build up a 40,000-volt charge from rolling along a dry road.

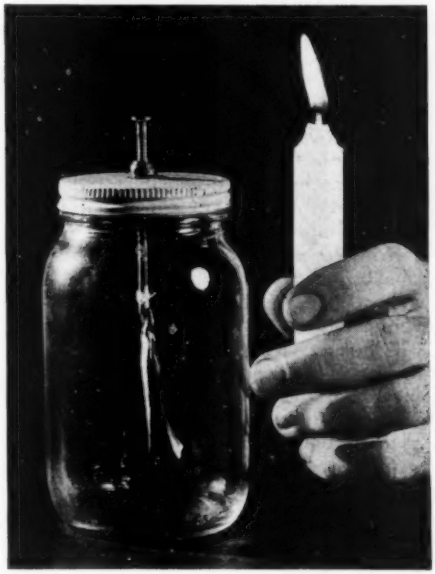
Friction is one way of producing close contact. But actual friction is not needed to produce static. For instance, a thoroughly dry photograph is charged with static when you peel it off a ferrotype plate.

How to eliminate static. An antistatic powder is now in common use in automobile inner tubes. Made of a conductive material such as carbon black, it is blown into the tubes to help drain off the charge built up by flexing. Some inner tubes have an antistatic lining.

Because moisture drains off static, humidification is a common method of static elimination. Extra moisture may be supplied to

STATIC IN PRINTING PLANTS. You may have seen small gas jets near the paper where it leaves a press. These flames have the job of eliminating static from the paper.

The homemade electroscope will show how this works. Charge the electroscope by pulling a comb through your hair and touching it to the electroscope knob. If you now bring a candle near the knob, the leaves will come together. The static is discharged because chemical action in a flame produces ions, electrically charged molecules. Ions of opposite charge to the static neutralize it.



WHERE TO HIDE FROM LIGHTNING. The best spot is inside an enclosure made of conducting material—an auto or steel-frame building. Since lightning is basically just static grown up, you can demonstrate this with a kitchen pot and wire strainer.

Set the electroscope in the pan, run a comb through your hair to charge it, and bring it near the knob. The foil leaves will separate, showing they are charged. Now discharge the leaves (by bringing a candle flame near them) and cover the electroscope with the strainer, being careful that it doesn't touch the knob. Bring charged comb near the knob. The electroscope will not be affected, for the strainer shields it.

the air (from which it will condense) or applied directly to the surfaces.

Vinyl records, plastic seat covers and leather substitutes used for upholstery are subject to static because they repel water. Static-eliminating solutions to be wiped or sprayed on such materials generally consist of a water-attracting substance such as ethylene glycol or glycerine plus a trace of a conducting chemical, sometimes just common table salt.

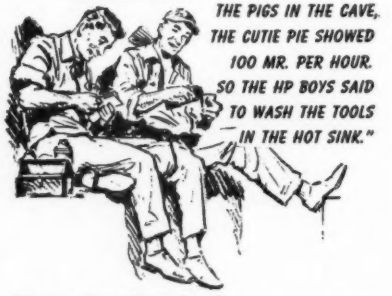
To remove dust from vinyl-plastic records without electrifying them further by rubbing, some manufacturers suggest that you wipe them with a soft cloth that is just barely damp.

How to make an electroscope. For some of the accompanying experiments, you will need an electroscope. You can make this from a glass jar, its metal cap punched with a ½″ hole, a large nail, thread, sealing wax and foil from a chewing-gum wrapper. The paper rubs off the foil easily after soaking in alcohol. The nail must be well insulated from the jar cap by the wax. An accompanying photo shows the assembly.

Any charged body brought near the knob (the nailhead) of your electroscope will cause the foil leaves to repel each other and fly apart. If you touch the body to the knob and then remove it, some of the charge will remain on the leaves, holding them apart.

Next Month: Ken Swezey shows you how to make "X-ray" photos with a luminous watch.

Shoptalk:



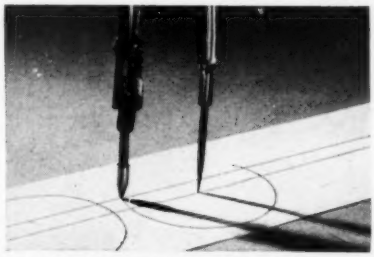
What are they talking about?

Where do they work? Answer below.

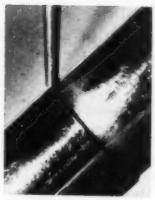
They work in a radiation laboratory. Pigs are lead containers for very hot radioactive sources. Vaults for storing such materials are called caves. A cutie pie is a type of radiation counter, and mr. is milliroentgen—a thousandth of the basic unit of radioactivity. HP boys are the Health Physics safety-squad members. The tools could not be decontaminated in a sink for mild activity. They had to be cleaned in a sink used for very hot stuff.

DO IT THE EASY WAY

TO RESTORE KNURLING on tweezer jaws, place the jaws on a mill file and apply pressure with a lock wrench or vise. —*Ken Murray, Colon, Mich.*



TO ELIMINATE RESHARPENING the pencil of a compass, substitute a refill cartridge for a ball-point pen. Tape the ink tube to make it the size of a pencil.

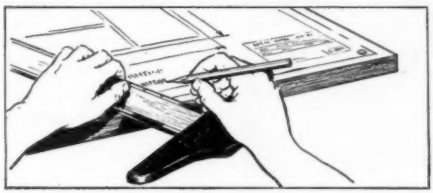


TO FREE jammed vacuum-cleaner attachments, pour a few drops of kerosene around the joint. Let it soak in for about 30 minutes and sections will come apart readily.—*R. F. Donovan, Guttenberg, N. J.*

TO AVOID RETINNING your soldering-iron tip so frequently, coil copper wire around it. This will increase heat radiation, preventing the tip from burning and pitting as rapidly.—*James Trusdle, Clyde, Ohio.*

T-Square Makes Lettering Aid

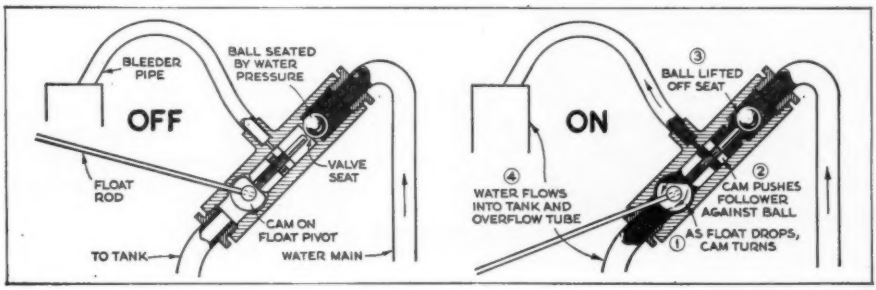
RESTING your hand on air while lettering the bottom of a large drawing makes a tough job of it. I hold a T-square across the board as shown. With a little maneuvering it makes an adequate hand rest.—*Stewart Rouse, Knightstown, Ind.*



Water Pressure Seats No-Dribble Valve for Flush Tanks

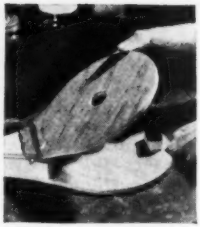
WITH only three moving parts, this new valve takes the place of the complicated and dribble-prone intake valve common in flush tanks. Instead of being closed by a float *against* the pressure of the incoming water, this valve closes *with* the pressure. The push of the water seats a stainless-steel ball to shut off the flow. A cam connected to the float arm nudges it off its seat when water is needed.

Invented by Samuel Kass of Philadelphia, the unit can be installed in any standard flush tank with only a wrench. Price, complete with bleeder tube and float, is $6.

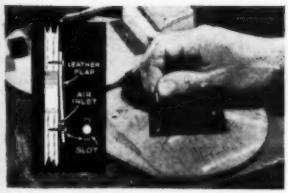


One-Evening Shop Projects

FINGER STRAP goes on pivoted side. Small wood strip gives fingers a better grip. Put a thumb strap on other side of the bellows.



HINGE movable side with a strip of soft leather. Mount a small stop as at right.



FLAP VALVE lets air in. Make it of pliable leather. Single tack at one end is only partly driven. It goes through slot in leather.

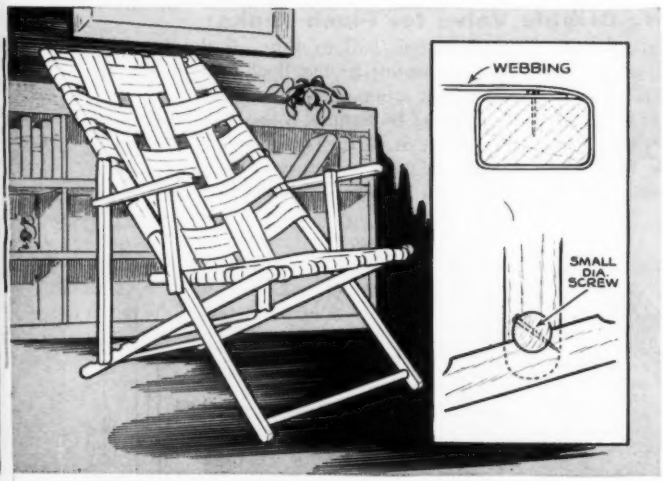
For starting a fire in a fireplace, this bellows will quickly coax a reluctant spark into a full-fledged flame. Its brass-tubing nozzle directs a blast of air just where you want it.

Cut two matching pieces of ¼″ plywood for the faces, shaping them like a pear. The fat end can be a circle of about 6″ diameter. The brass tubing should be a drive fit in a hole drilled lengthwise through a spacing block sandwiched between the neck sections.

Drill a 1″ hole through the center of one of the faces, and cut through the neck of this same piece. Fasten the two cut parts together with a leather hinge. Attach a flap valve inside the hole. Make a felt-padded stop block.

For the bellows you can use soft leather, sheepskin or vinyl upholstering material backed with cloth. Glue and tack it to the edges of the plywood members with the hinged piece in its normally open position. Test for leaks by holding the nozzle shut with your thumb while squeezing the bellows sides together.

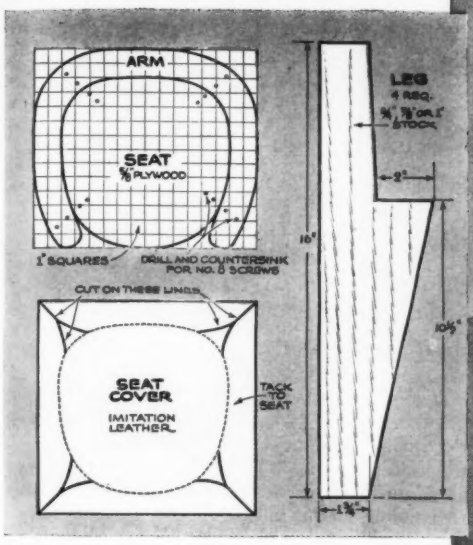
Building time: two hours.

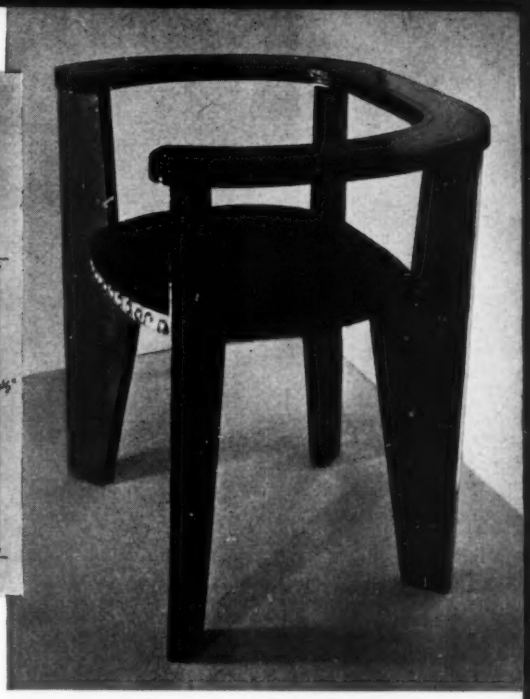


Here's an extra chair for TV viewing, easily made from an old beach chair. Rip off the old canvas, tighten up the frame as required, and screw the brace ends to the back legs to make the chair stay open during handling. Paint the frame to suit your room.

Buy about 10 yards of the burlap webbing used on the underside of upholstered chairs. Try to find webbing that has decorative striping. Cut into strips of the required length, loop the ends around the frame members several times, and tack on.

Building time: 1½ hours.





A child's chair may seem like too big a project for a single evening. But this one isn't. Besides being easy to make, it is stout and attractive.

One piece of plywood, measuring 14″ by 16″, will serve both for the seat and combination arm and back. A bandsaw or jigsaw makes quick work of the cutting. Four scraps of any ¾″ stock at least 4″ by 16″ will take care of the legs.

Sand all parts, and drill and countersink the arm and seat at the indicated points for 1¼″ flathead screws. Assemble with glue as well as screws. Fill the arm screw holes, and paint or stain the chair as desired.

To fit an imitation-leather seat cover, make a Y-shaped cut at each leg. Use quilting cotton as padding. Pull the leather tight and tack it underneath the seat. Space upholsterer's nails evenly around the edge.

Building time: four hours.

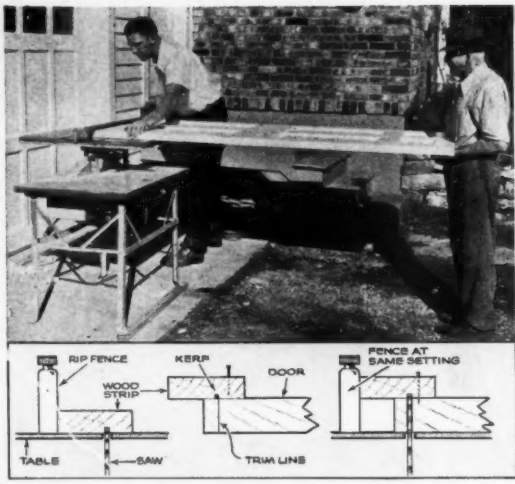
For an artistic touch in your home, build this palette tray. Two plastic drawer pulls and a 8¾″ by 13″ sheet of ¼″ birch-surfaced plywood are what you need.

Bandsaw the plywood to oval shape. Make the thumb hole by first boring a 1″ hole. Then cut to the outer edge and round the corners with a wood rasp. Sand all surfaces. Countersink holes underneath for the handle screws.

Apply a coat of shellac, let it dry, then sand lightly with fine paper. To represent the colors an artist might spread on the palette, apply irregular splotches of lacquer, paint or enamel to the wood. Wax the wood after this has dried. Screw on the handles and glue thin felt to the tray bottom.

If you wish, form a metal fence around the edge to keep things from sliding off.

Building time: one hour.

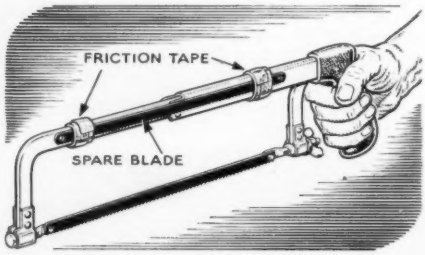


Circular Saw Trims Doors

A DOOR can be trimmed top and bottom in minutes on a circular saw.

In a straight strip of wood a bit longer than the door is wide, rip a kerf ⅛″ deep about 1″ from an edge. Leave the rip fence locked. Tack the strip across the door with a couple of finishing nails, aligning the kerf with the trim line you have marked on the door. Get a helper or set up a roller guide to hold the far end of the door as you make the cut.

Adjust the saw blade to cut through the door, and guide the door by keeping the strip against the fence. The two nail holes can be puttied, and won't show after the door is painted.—*Glenn A. Wagner, Delmar, N. Y.*

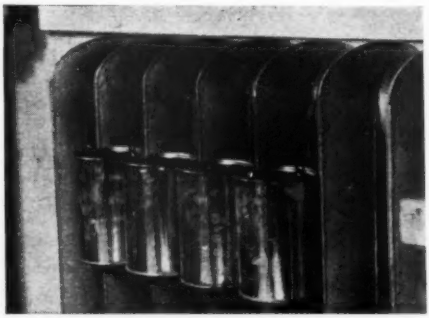


Tape Keeps Extra Blade Handy

I HITCH a spare blade to the handle of my hacksaw. Then I have a replacement always handy and don't have to paw through a loaded tool box to find a blade in an emergency.—*W. Fitzpatrick, Yonkers, N. Y.*

Scrap Pipe Forms Tripod Stands

PORTABLE stands that are light but strong, can be made of 1″ pipe welded into tripods. They are useful for racking pipe or lumber off the ground. Weld a curved piece of pipe to the tops of the stands and they will also hold drums as shown at left. Easily carried and set up, they are fine where frequent moving is necessary.—*E. V. Reyner, Townsend, Mont.*



Tin Cans Make Humidifier

SOLDER together three or four 3″-diameter tin cans and you have an efficient home humidifier. Hooks cut from a wire coat hanger will hold the unit to a radiator.—*A. Zanelli, Wyckoff, N. J.*

Sawing Tapers to the Line

These homemade adjustable jigs make taper sawing a pleasure instead of a peril.

ONE of the tougher operations on the circular saw is cutting long, narrow, tapered pieces such as table legs or pedestals. The fixtures sketched below will make it a lot easier to cut tapers, and they will relieve your fingers of the responsibility of guiding narrow work between fence and blade.

One of the fixtures can be knocked out in minutes. Two strips of ¾″ stock joined by a rectangular piece of ¾″ plywood are all you need. A small block of wood may be added for a handhold. One strip is permanently nailed to the plywood, while the other, notched, strip is fastened at the leading end by one nail. It is set to taper position at the trailing end by another nail that is driven in part way.

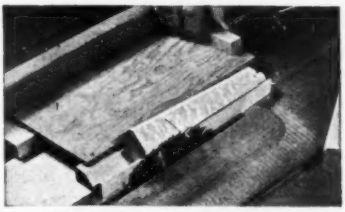
A useful accessory for the jig is a V-block attachment. This V block is substituted for the notched strip, and work previously tapered can be chamfered on the tapering corners—a ticklish job without the help of the jig. About 12″ long and 6″ wide is a good size for the jig.

For a permanent shop fixture the quick-setting jig is better. The construction is basically the same but it uses heavier stock, is assembled with screws, and has an adjusting slot with locking wing nut and a hardwood clamp to hold the work. A somewhat shorter V block can be clamped in place on this jig, eliminating the necessity of removing the notched strip.

Use a stop, clamped to the fence, to keep you from pushing the clamp and bolt into the saw blade. When making long cuts, down to the end of the work, the clamp and bolt should be removed from the side of the jig. A coat of shellac followed by a coat of machine gray will complete your new shop accessory.—*Glenn A. Wagner, Delmar, N. Y.*

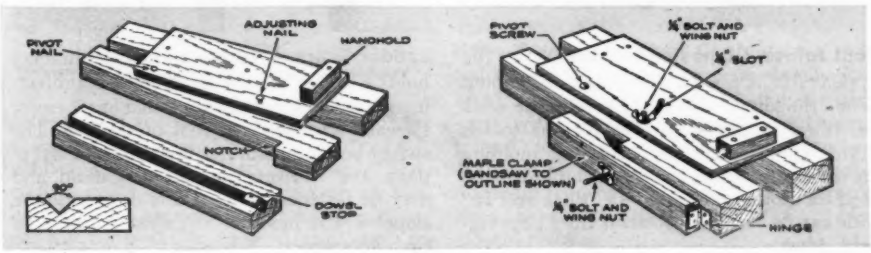
THE JIG IS SET by lining up the taper layout lines on the stock with the miter groove in the saw table. Then adjust the fence to line up the stock for the cut.

THE JIG IS GUIDED by the rip fence. Fingers need not come near blade. Little finger straddles fence.



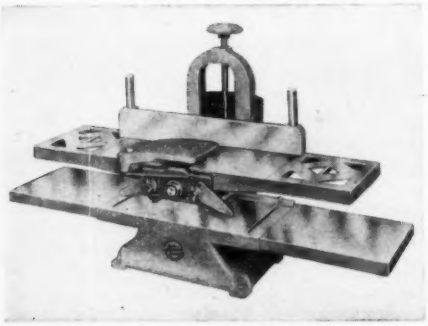
V ATTACHMENT IS SUBSTITUTED for the notched guide strip for cutting chamfers on the tapering corners. Work should be held down lightly to prevent vibration.

THE QUICK-SETTING JIG does a production run of model-airplane wings. Stop is clamped to fence.

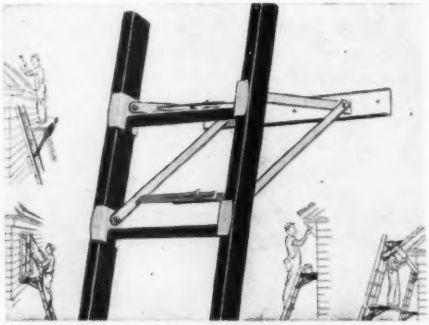


New Tools

Keyhole Saw Needs No Hole. Powered by any heavy-duty ¼" electric drill, compressed-air drill or flexible shaft, this saw speeds keyhole sawing because no starting hole is needed. In use, the tool is held tightly against the work and rocked into an upright position with the guide used as a fulcrum. A built-in blower cools the saw and also blows sawdust away from the cutting line. Nearly any kind of material can be cut with the special blades that are available as accessories. The stroke is ¾". *RCS Tool Sales Corp., Joliet, Ill.*



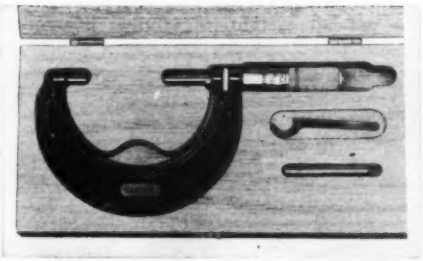
Tool Joints, Planes and Molds. When the upper table is used, this tool is a 6" jointer. When the lower table is used—with the work fed from the opposite direction—the tool is a thickness planer. By installing molding knives in the head, the lower table can be used for molding. Lumber 4½" thick and 11" wide can be planed. *Toolkraft Corp., Springfield, Mass.*



Ladder Bracket Adds Reach. This bracket holds a ladder away from the house, protecting gutters and cornices and making it easier to reach windows and roof projections. The swivel bearing plate positions itself. Used in pairs, the brackets support a scaffold and may be fastened either inside or outside the slope of the ladders. *Steadfast Equipment Co., Thornwood, N.Y.*

Bolt-Clearance Sockets. This set of long sockets lets you reach many hard-to-get-at adjustments without extensions. They are especially suited for ignition, carburetor, radio and dashboard work. The eight sizes run from 3/16″ to 7/16″. The sockets have a ¼″ drive and are 2″ deep. *Bonney Forge & Tool Works, Allentown, Pa.*

Detachable Hook for Steel Tapes. Measuring long lengths of pipe, sheet metal and other big work is simpler with this hook for the end of the tape. Made to fit ¼″ or ⅜″ Starrett steel tapes, the hook is serrated to provide a secure grip. *L.S. Starrett Co., Athol, Mass.*

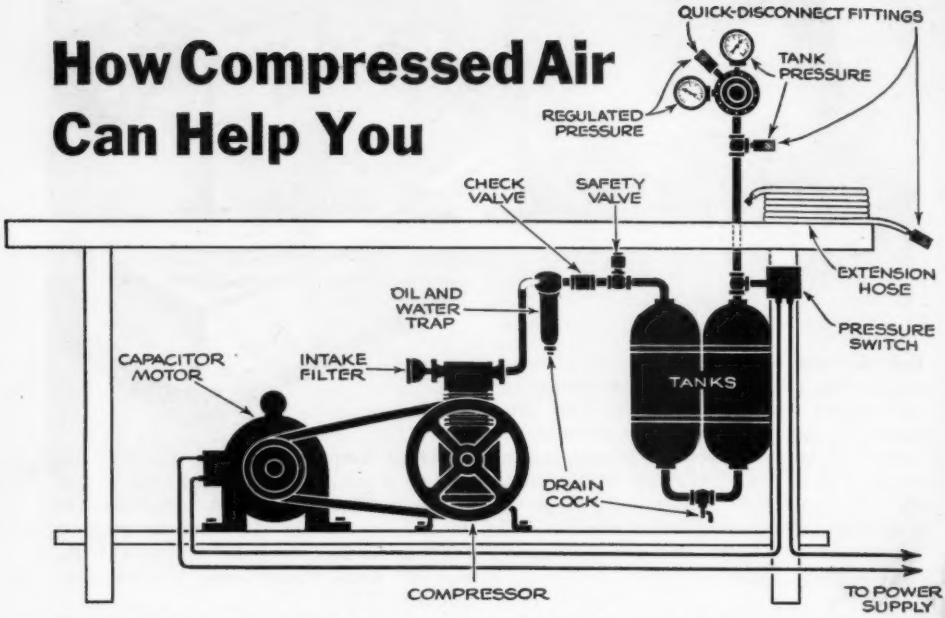


Micrometer for Crankshafts. The range of this tool—1½″ to 2½″ with a 3″ frame—handles most crankshaft diameters. The reading point is on the underside of the thimble so it shows when the mike is in use. *L.S. Starrett Co., Athol, Mass.*

Gearless Sander. Servicing problems are held to a minimum by the gearless design of this sander. A universal motor revolves the abrasive pad in a ¼″-diameter orbit at 4,000 r.p.m. The tool is 4⅛″ wide, 6½″ high, and 9½″ long. *Porter-Cable Machine Co., Syracuse, N.Y.*

Hone Carries Its Own Coolant. No special skill is required to turn out highly finished surfaces on cylindrical and tapered parts with this hone. It covers diameters from ¾″ to 3″, using abrasive sticks that are available in all grit sizes. The oiler has a finger-tip control to regulate the coolant flow. *Universal Power Sprayer Co., Plymouth, Mich.*

How Compressed Air Can Help You



Compressed-air system can be installed under workbench, provided you use a belt guard.

Here's a chore boy you can cram into a tank and put to work at dozens of jobs in your workshop and garage.

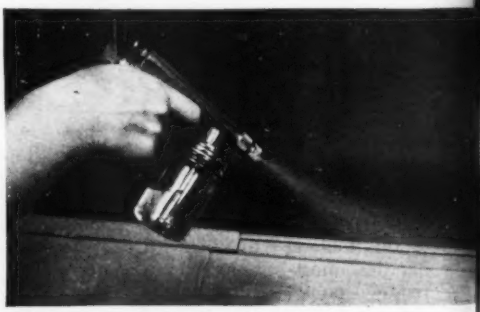
By Howard G. McEntee

IN CASE you think an air compressor would be a luxury for your shop, let me tell you different. There are almost limitless applications for air under pressure. Sure, you do your painting very well with a brush. Where else would a compressor help? Well, just see what you have been missing.

You can hitch that air to a gas torch for a hot, clean flame that makes a soldering iron feel tepid; you can use a nozzle for blowing out chips or sand; you can tap off a little pressure to aerate an aquarium; you can run an extension to the garage for blowing out gas and oil lines, testing for engine-compression leaks, touching up the results of your wife's fendering through traffic, and, of course, inflating tires.

Couple a hose to a small sandblasting box and you can etch frosty designs on plastics, clean spark plugs, satin-finish tools or silverware and clean grime from statuettes and ornaments. A whole new field of decorative finishing is opened to you: flocking, crinkle-finishing and lacquering. If you do production runs in your shop, you will find a pneumatic vise the fastest work grabber you have ever seen. The list grows as you become air-minded and shop the surplus marts for small pneumatic tools.

The compressor. This is the backbone of your air system, of course. I favor a



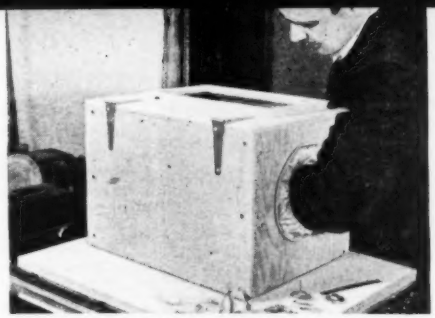
SPRAYING PAINT is the classic use for compressed air. It is not only far faster than brushing but it also does a better job.

piston job; the diaphragm types are designed for a direct hookup to spraying equipment, rather than maintaining pressure in a tank. Try your refrigerator serviceman for a unit with good bearings, valves and piston fit. Don't turn down a refrigerator compressor simply because of its ancient vintage. I salvaged a real old-timer, in good condition, for five bucks.

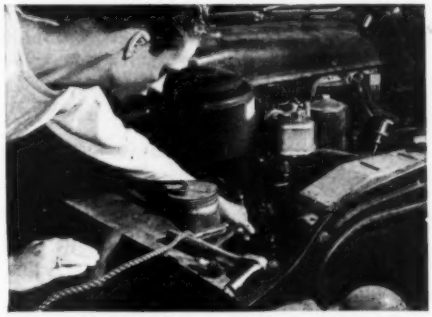
The old ones are ruggedly built and a little leakage in the valves may even help. It allows the residual air pressure in the cylinder to drop between runs so that the motor doesn't have to start up under full load. Some refrigerator compressors are equipped with fan blades built into the drive pulley. If yours is not, and you expect to do spraying or other continuous operations, mount a small cooling fan to blow on the cylinder fins. A friction drive off the belt will spin it.

Motor. A ½-hp. electric motor is ample to drive most small compressors, and a ¼-hp. might do. The motor should be the capacitor-starting type, though a less expensive split-phase motor will serve if you fit a centrifugal pulley on it, or use an automatic pressure valve with an "unloader." This gadget releases pressure in the cylinder to reduce the starting load—in the same manner as slightly leaking valves.

Pulley ratios should be selected so that the system reaches its maximum pressure as rapidly as possible without overloading the motor. Be sure the belt is tight, because a loose belt may not turn over the compressor if it has stopped on the compression stroke. Friction of the loose belt may then hold the motor speed down so that it runs on the starting winding. And that may burn out the motor.

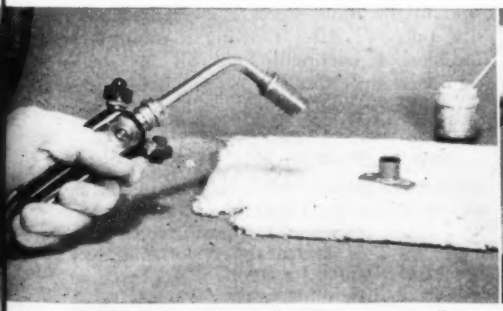


SOME SHARP SAND, a tightly built box (see page 215) and plenty of air will enable you to etch plastics, satin-finish metal parts.

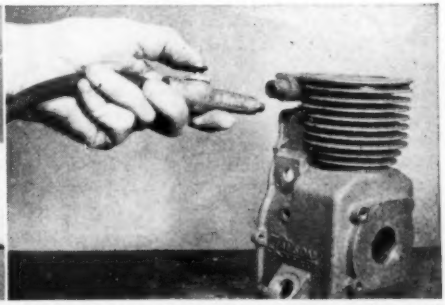


AN OLD SPARK PLUG, converted to an air fitting, is a big help in checking for compression leaks in your auto engine.

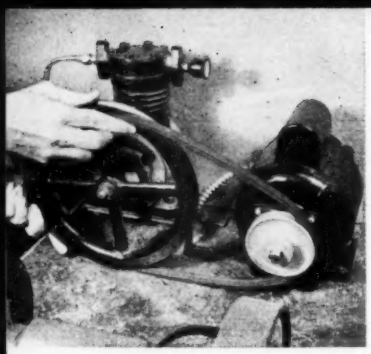
Controls. I used a manual on-off switch for several years, relying on the pop-off valve to backstop me if I forgot. An automatic pressure switch, however, is better. It operates the compressor only when the tank falls to minimum pressure and shuts it off when full pressure is reached. A modest differential between the cut-in and cut-out pressures, say 15 lb., will keep the motor from running every time you use a



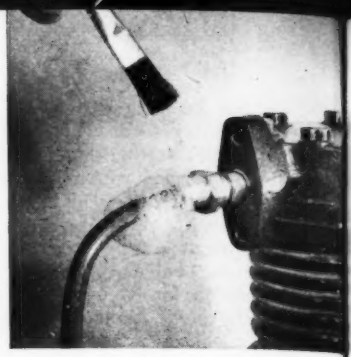
COOKING GAS, boosted with compressed air, produces a hot, clean flame suitable for silver soldering and brazing.



SHOT FROM A BLOWING NOZZLE, a forceful stream of air will clean castings, blow out dirt or chips, and dry odd-shaped objects.



KEEP THAT BELT TIGHT! A loose belt may allow the pulleys to slip, yet hold motor down to its starting-winding speed, resulting in a burned-out motor.



BUBBLE FLUID or soap solution gives you the tip-off on leaky joints, which are usually plentiful in a new system. Just brush it on and watch for bubbles.

bit of air. It is important to use a pop-off valve to police the pressure switch.

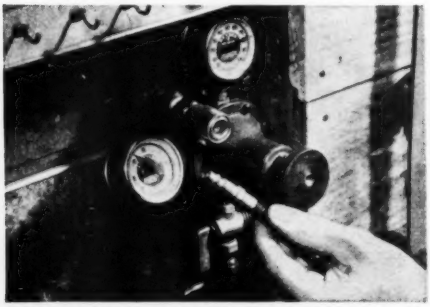
If you don't want the system running when you are not in the shop, connect the motor in parallel with the shop lights. Then the system will swing into action only when you are likely to want air.

A check valve installed between the compressor and tank prevents leakage back through the compressor valves when the motor is off. I find a maximum pressure of 80 lb. is sufficient for most shop needs. The pressure switch is set to maintain this value and the safety valve pops off at 100 lb.

A dust filter should be mounted on the intake opening of the compressor. These may be purchased with a nipple threaded to fit, or you can make one from a small tin can filled with lightly oiled steel wool. Clean it occasionally with gasoline, and re-oil.

Storage tank. Some of the best ones I have seen are the war-surplus, 12″ by 24″ stainless-steel oxygen tanks, which have threaded outlets at each end. Two of them in series hold plenty. Mount the tanks vertically and include a drain cock on the lower connection to drain off the water that condenses out of the moist cellar air.

An oil and water trap fitted between the compressor and the tank collects the first bits of condensation along with the oil mist thrown up by the piston. Any such contamination is bad for paint spraying.



AN OXY-ACETYLENE REGULATOR is a handy accessory. Adjustable, it lets you use air at a lower pressure than that in the storage tank.

Spraying, and some other operations, require a much reduced pressure, but a constant flow. For maximum convenience, this calls for a reducing or regulating valve. I picked up a bargain in a used acetylene reducing valve equipped with two gauges: a regulating gauge, which gives good control from 0 to 30 lb., and a capacity gauge, which indicates tank pressure. Valves, tanks and traps are connected with ¼″ copper tubing and flare fittings, sold by auto-supply houses.

Hose. Heavy-duty windshield-wiper hose makes fine air line. Be sure you get the type with at least one fabric layer molded inside. For real convenience, fit all hoses with quick-disconnect fittings; see your auto-supply dealer for these. They allow you to snap the hoses together—no screwing up threads. They also have internal valves that close automatically to retain air pressure even though the gun or other tool is disconnected.

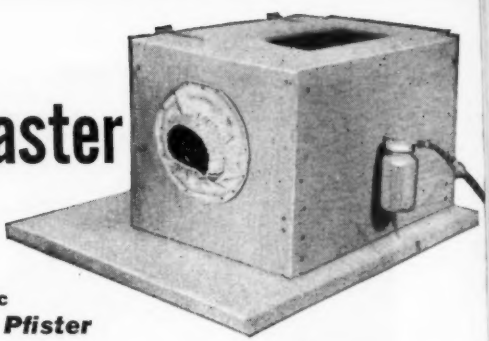
Leaks. Do not be surprised if, when all connections have been made, you find plenty of leaks. Search them out by brushing soap suds on every joint. The kids' bubble liquid sold in the dime stores is even better for this purpose. After blowing a roomful of bubbles, I eventually got all my leaks tightened up. Now my system holds pressure for weeks. END

How to Machine Jets' Metals Told

HITHERTO unpublished data are now obtainable on how to machine the high-temperature alloys used in jet engines, the Department of Commerce Office of Technical Services announces. Results of research for the U. S. Air Force are contained in the 161-page *Air Force Machinability Report—1950.* A cloth-bound, illustrated edition is available at $2.40 from the Curtiss-Wright Corp., Wood-Ridge, N. J.

Homemade Sandblaster

Is Handy Finishing Tool



High-velocity jet of beach sand etches plastic and puts satin finish on metal. ***By Herb Pfister***

IN SECONDS a jet of flying sand can finish off the surfaces of such hard-to-polish items as ornate silverware, costume jewelry and irregularly shaped castings. It will clean spark plugs and apply a lustrous satin finish to metal. Frosty designs are quickly etched in plastic when part of the masking paper is cut away. Small brass details in model work look like real sand castings when they're sandblasted.

The sand gun is nothing more than a brass tube soldered to a jar cap. *Punch* a ⅛" hole in the cap to form a tiny funnel and line it up with a 3/16" hole drilled in the tube. A length of ¼" brass rod is drilled as shown and soldered into the tube just behind the hole. The projecting end of the drilled rod becomes the nipple for the air hose. Since the sand falls into the airstream beyond the No. 70 hole, the hole won't enlarge in use, as is often the case with commercial sand guns.

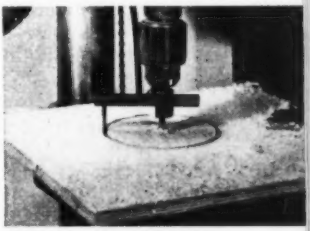
The parts for the sandblaster probably can be found around the house. (This is a particularly good time to point out to your wife that the "junk" you've been saving isn't really junk at all. That old coffee-percolator sieve, filled with steel wool, becomes an efficient dust filter, and a sleeve with an elastic cuff seals off the armhole while you're blasting away inside.)

Use ½" plywood for the box and cement strips of felt around the top edge to prevent dust seepage under the cover. Window glass in the cover lets you see what you're doing.

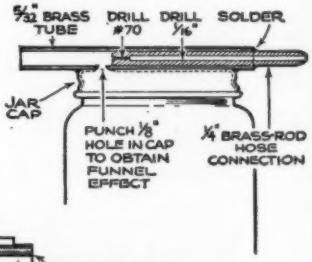
The sand may be scooped up from the bottom of the box and used over and over again. In time the grains may grow dull and should be changed. I've been using the dry, white beach variety and it has handled every job I've put it to.

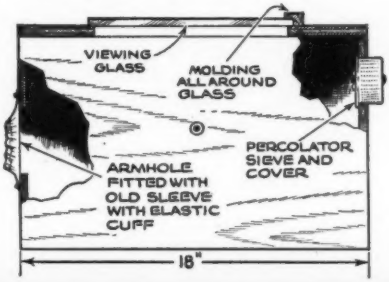
Before filling the jar sift the sand through a kitchen strainer. The gun is then inserted in the bushing and inverted, allowing the sand to trickle into the tube. I've been using 40- or 50-lb. pressure. Unless you have strong objections to a satin-finished thumbnail, there's no need to wear a glove. Turn the work constantly in the hand, peering through the glass viewer to keep it in the line of fire. You'll find that the sand stream cuts best three to five inches away from the nozzle. It won't take long to learn how to hold objects on the receiving end of this sand bazooka. END

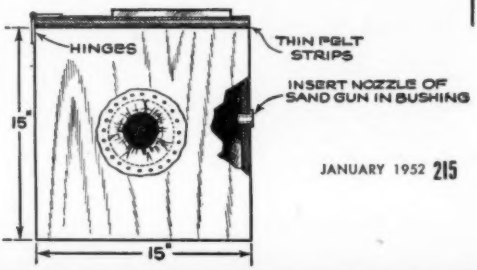
SOLDER tube assembly to cap after aligning punched hole in the cap with drilled hole in the tube.

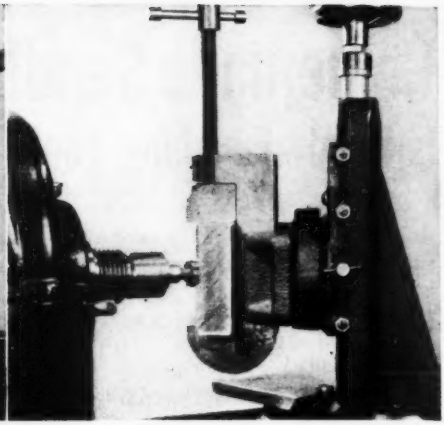


USE an adjustable circle cutter to form armhole and opening for the percolator sieve.









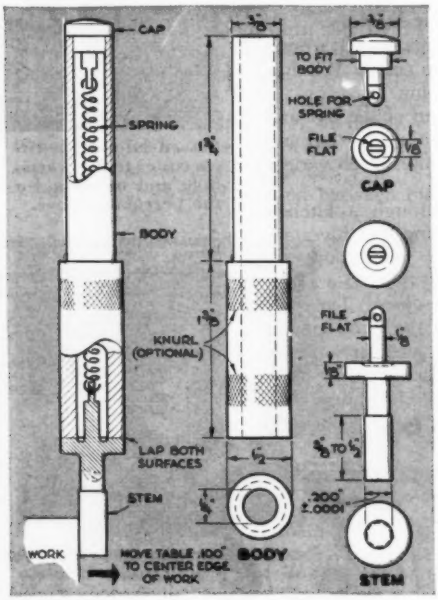
Boost Milling Capacity. Many a job can't be handled in the lathe milling attachment because it won't fit. For example, I had to mill some dural bar 3¼″ wide, but the vise jaws opened only to 2¼″.

They would have been weakened excessively if cut back to take this stock. What I did was remove only enough material to clamp in a 2½″-wide drill-press vise. This in turn I modified to hold the 3¼″ stock.

For opening out the attachment jaws, the vise was set square to the ways, with both scales at zero. With all lathe and attachment gibs tightened, ⅛″ was milled from each clamping face as at the left above.

The two hardened faces of the drill-press vise were removed, the sliding jaw taken out, and 3/16″ machined off it. Reassembled without the hardened faces, the vise would now take stock up to 3¼″. It was clamped in the milling attachment, and the 3¼″ dural bar was held in it for beveling as at the right above.

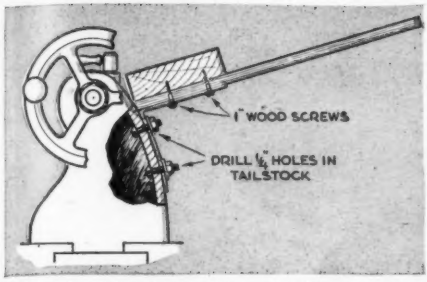
Although this increases overhang, I can take cuts up to ¼″ on aluminum, brass and mild steel.—*H. L. Truchelut, Atlanta, Ga.*

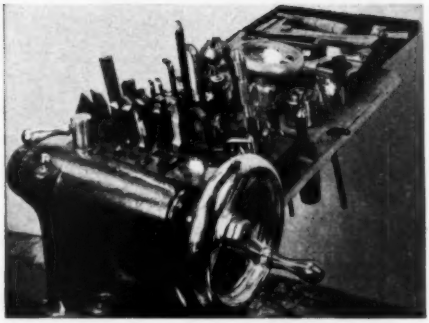


Wiggler for Vertical Use. In my work, I've found this homemade wiggler handier and more accurate than the ball type. Although I use it chiefly on the milling machine and jig borer, it can be used on a lathe or drill press, too. It is held in either a spring or Jacobs chuck, and will work even if the chuck itself doesn't run true.

To use it, tap the stem a bit off center and start the spindle turning. Then move the work up against the revolving stem. You'll see at once when it is running dead true, and it will run off center the moment you go a couple of ten-thousandths past.

The stem is lapped to .200″. When it runs true, the table need only be moved half that to center the edge of the work under the spindle. Make the tool of drill rod so that it can be hardened all over. After hardening, grind and lap the bottom face of the body. Lap the mating surface of the stem (which is undercut to reduce its bearing area) to the body. The cap may fit freely, as it is held in place by the spring. —*Fred Philips, Queens, N. Y.*



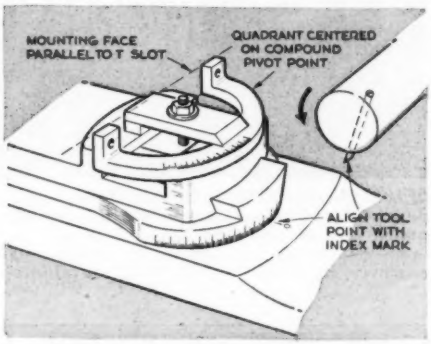


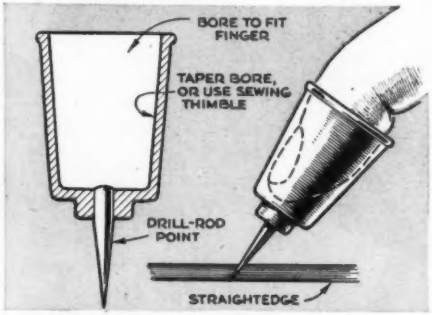
Tailstock Tool Holder. You'll save many a minute at the lathe if you keep tool bits, cutters, chucks, centerdrills and other frequently needed accessories in this tailstock-mounted holder.

It consists of two pieces of wood held on by two metal brackets. Holes are bored in a 7″ by 14″ panel of ⅜″ plywood to receive large items that have a shoulder or flange to keep them from slipping through the board. A 1½″ by 4″ by 7″ block fastened to the inboard end of the panel is bored to hold bits, boring bars, centerdrills and other small tools.

Graduating in Degrees. You can mark a quadrant in degrees on the lathe. Clamp it on the compound with a shoe and bolt as shown, adjusting it to swing true on the compound center.

Chuck a boring bar with a sharp V tool set to cut a line on the work (block up the latter if necessary). Lock the carriage with the tool aligned on the compound index mark. Lock the compound and advance the work into the rotating cutter. Line length can be gauged on the feed collar. Reset the compound as necessary for the divisions wanted.—*Bernard J. Corey, Thorold, Ontario.*





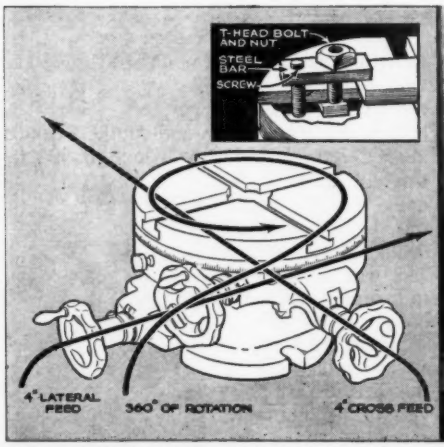
Thimble Scriber. When a scriber is in constant use, wearing it on a finger gives your hands more freedom. Make the thimble of brass and the point from drill rod or a hardened dowel pin. You can also silver-solder the point to an ordinary sewing thimble.—*Jose Sobkowiak, Jackson, Mich.*

Drilling at an Angle. Where precision isn't called for, a simple wooden jig does this hard job the easy way.

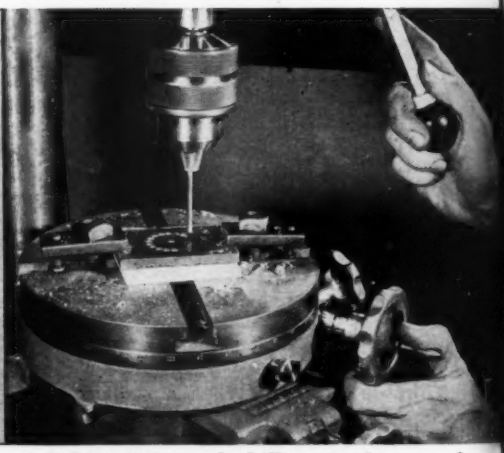
Cut a piece of 2″ wood at the drilling angle required, and bore a hole at 90° to the cut to hold the work. (In the photo, 45° holes are being drilled in a pipe cap. This was threaded onto a nipple set in the hole.)

Screw the block to a wooden base. Clamp this in the drill-press vise or to the table, centering the punch mark under the drill. Rotate the work for each hole.—*W. Haase, Hartford, Conn.*

DE LUXE MILLING TABLE and some work it does: panel formed on wood, hole in a lens board, punch with ground flats, hex end formed on brass rod, panel for rotary switch, numeral engraved in wood, engine finish on aluminum, clock face of plastic, hollowed-out walnut block for ring box, slotted aluminum piece and curved slot in pressed-composition panel. Setups for most of these jobs are shown in accompanying photos.



THREE DIFFERENT FEEDS, indicated by the arrows, are provided in this milling table. Insert shows a hold-down clamp made from a length of steel bar, bolt to fit T slot in table, and stud threaded for screwdriver adjustment.



A ROTARY FEED speeds drilling circular rows of precisely spaced holes. The holes being drilled here are to hold the points of an experimental rotary switch. Same job can be done on two-feed table by indexing table.

Milling in Your Drill Press

With accessory table and cutters you can turn out tricky jobs that you couldn't tackle any other way.

By Walter E. Burton

IF YOU would like to own a milling machine but can't spare the dough, a milling table mounted on a good drill press often makes a satisfactory substitute.

The de luxe job shown here is equipped with two cross-feeds at right angles to each other, plus a rotary feed. The table thus can be rotated on its axis and moved in two directions. Micrometer collars on the cross-feed handwheels indicate table travel in thousandths of an inch. A scale around the circumference of the table shows rotary movement in degrees.

A less expensive model has the two cross-feeds but no rotary feed. Fixed rotary settings may be made by loosening two setscrews on the table base and turning it by hand. It has a degree scale around the hub.

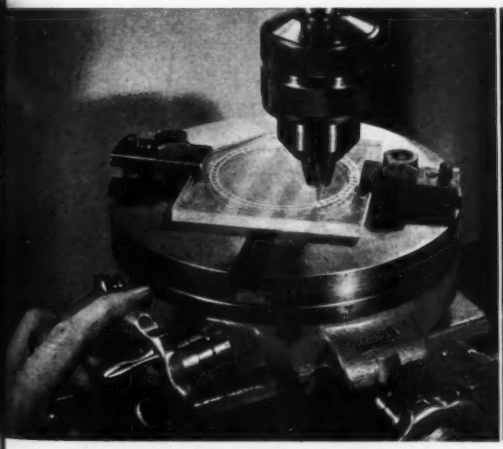
Installation of the milling table is a jiffy job; you just bolt it to the drill-press table and you're all set. Work is mounted on the milling table with T bolts and hold-downs. These T-head bolts will also tie down a drill-press vise.

Depth of cut is controlled by setting and locking the drill-press spindle. If there is play or looseness in the spindle, you'd better forget the whole deal, at least until you take up the play or rebush the drill press. Accurate milling just cannot be done when the cutting tool is jumping all over the work.

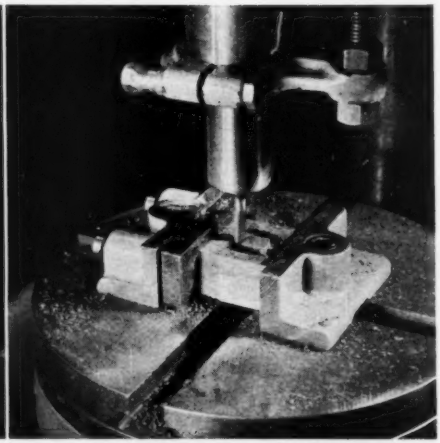
Spindle speed should be suited to the cutting tool and the material; generally, you will want to use low speeds in milling metal, and high speeds in routing wood.

The drill-press chuck, or preferably the safer setscrew chuck, holds such cutting tools as twist drills, wood-boring bits, routers, milling cutters, slitting saws, grinding wheels and sanding drums or disks. In any operation involving side thrust on the tool, use a positively attached chuck, not one mounted by taper alone. A loose drill-press chuck can be a lethal weapon that will raise your hair if it doesn't part it.

Please turn the page for nine more milling-table setups.

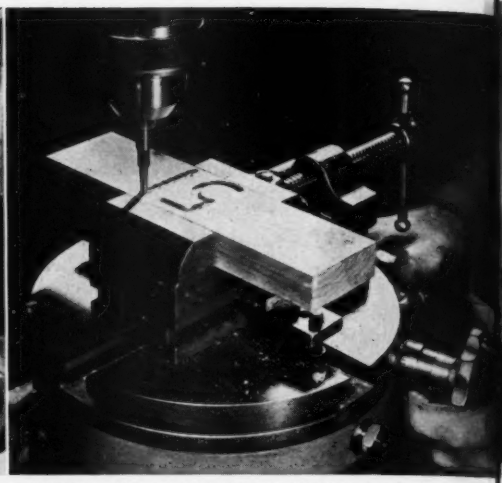


ENGRAVING A CLOCK DIAL on a plastic sheet is a simple job. The engraving tool used was a discarded dental ball bit, operated at fairly high speed. Rotary movement forms rings, cross movement the minute marks.

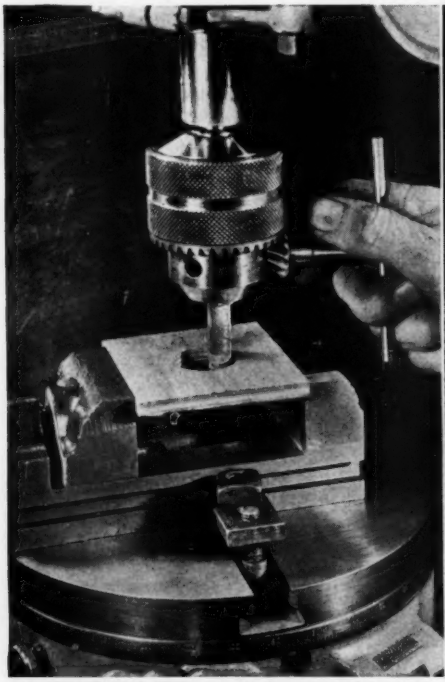


A HARDWOOD BLOCK being hollowed with a ¼" wood-routing bit to form a ring box. To hold such work, a special vise may be purchased to fit the T slots in the table. Jaws can be locked anywhere along the table slots.

ROUTING PANEL IN WOOD. The drill press table is tilted to the desired angle for the panel edge. Because of this angle, the table must be rotated after each cut so all cuts are made in the same direction.

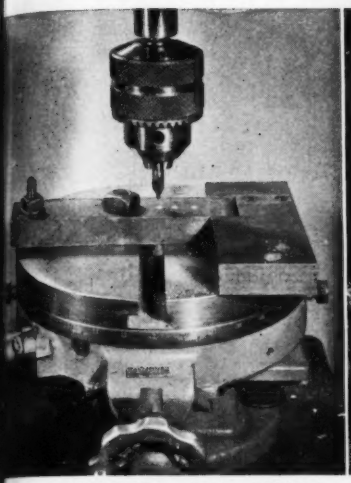


ROTARY AND CROSS-FEED MOVEMENTS of the table permit neat letters and figures to be engraved in wood, plastic or metal. A router bit designed for engraving should be used. Test cuts are advisable.

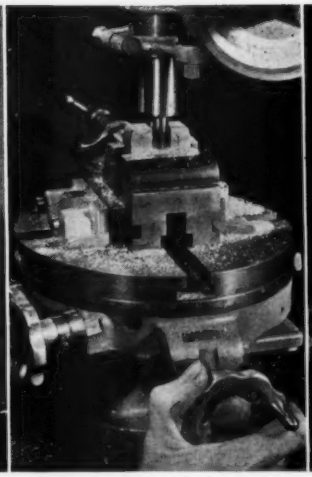


USING ROTARY FEED, a hole in a lens board is sanded with a small spindle. Unless hole was bored at same setup, be careful to locate it over the center of rotary table.

GRINDING WHEELS of various shapes mounted in the safety spindle chuck convert the milling table into a precision grinder. A cloth protects the table from grit.



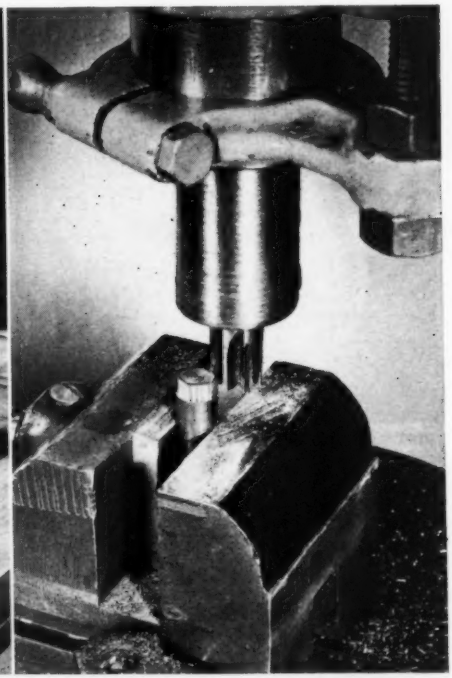
CALIBRATED FEED SCREWS make it possible to position holes to close tolerances. Start the holes with a center-drill, follow with twist drill.



END MILLING a ½″ slot in aluminum. Keyways are similarly cut in shaft ends. Cross-feed of milling table is used to move work.

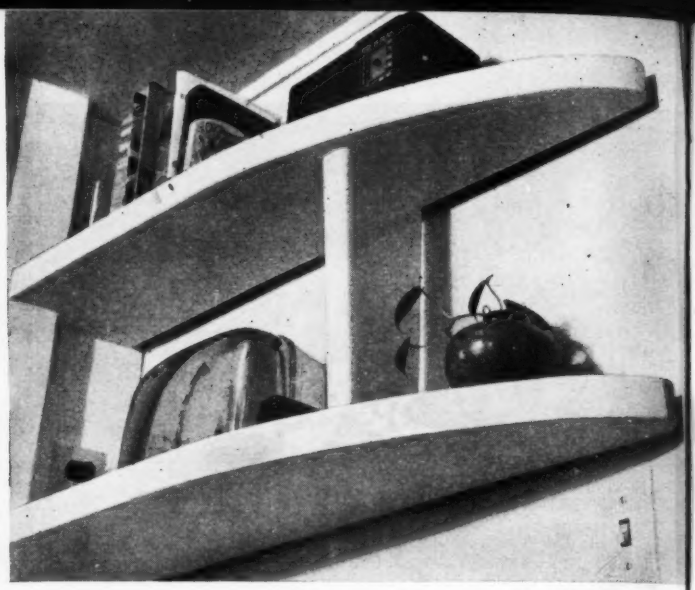
SLITTING SAW mounted on arbor is useful for making split rings and bushings or slotting screwheads. Slits in collet chucks are easily cut.

SURFACE FINISHING of type known as spot polish or engine finish can be applied to work with a felt-tipped rod charged with fine abrasive, such as valve-grinding compound.



ENDS OF SHORT RODS, studs and bolts may be milled to a square, hexagonal, octagonal or other shape. The work must be centered over the axis of table or head will be offset. END

How to Round Corners



CORNER SHELVES were streamlined and modernized by rounding corners. Shelves are solid stock.

By Robert Hoppough

TODAY'S trend in furniture and cabinetry is toward smooth, flowing lines. Many of these effects are achieved by steaming large panels and bending them under pressure—a process far removed from the home workshop. But even in small shops much can be done to turn out modern pieces with plenty of eye appeal.

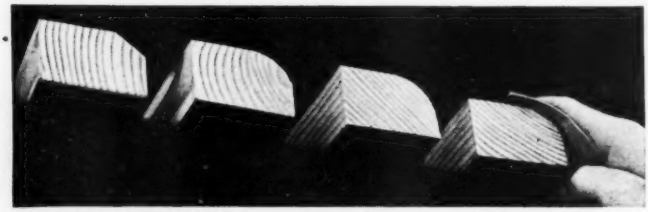
DISK SANDER speeds work. Corner was rough-sawed to shape, then rounded on sander.

Simple units like the corner shelf above are relatively easy to round off. You just cut them to rough shape and finish off with a plane, rasp and sander.

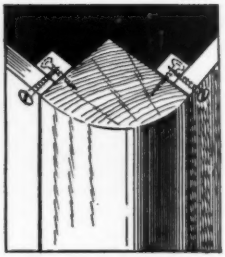
Guard against splits. A little extra care must be taken when planing end grain. The plane must be worked from the edges to the center, rather than straight across the board end, as there is danger of splitting off a chip at the edge. Glue will repair minor accidents.

Rounding long pieces. Here the main problem is uniformity. You can use a disk-sanding attachment in an electric drill for the roughing, but more uniform results are achieved by using the progressive method shown below.

The corner is first planed or sawed to about a 45° angle. Further planing re-



ROUNDING BY HAND: Plane corner to 45°, reduce high spots of angle by more planing, and finish by hand. Built-up corner is at right.



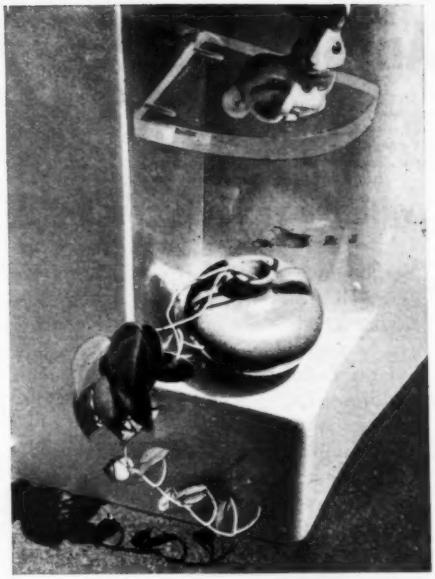
duces the two high spots of the angle and begins to round off the edge. Final finishing is done with sandpaper held in fingers.

Flat areas or bumps should be sanded out carefully. Finish with an over-all sanding with fine paper held in the fingers or wrapped around a block of cork.

Built-ups. Larger pieces must be built up, using thin panels glued to a framework to form the desired shape. Composition board is ideal for this construction and is inexpensive as well. Where two panels meet to form a corner they may be joined by a length of 2″ by 2″ pine. Two ½″ by ½″ cleats are screwed and glued to this corner post to form a fabricated rabbet. The panels are then glued and nailed to the cleats and the corner post rounded off.

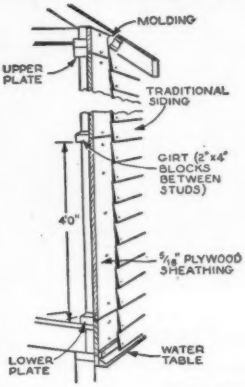
Kerf curves. Another interesting treatment for curves is the application of a plywood apron or baseboard nailed to a curved shelf. The plywood is kerfed vertically on the back surface with a series of saw cuts about two-thirds through the material to facilitate bending. Spread glue on the shelf edge before nailing the plywood. This reduces the possibility of cracking after finishing.

Although close-fitting joints are always desirable, don't fret too much if you can't make the pieces match to a hairline. There are plenty of excellent nonshrinking wood fillers to fill in imperfections, and a good coat of paint can hide a multitude of sins.



MIXTURE of wood and composition board in built-up at right becomes attractive piece above under unifying magic of enamel.

PLYWOOD SHEATHING



Plywood sheathing applied to ordinary frame construction imparts stiffness equal to diagonal boarding and saves much labor. Studs should be cut 1½″ less than 8′ to provide an edge ia · for nailing the plywood to the plates. If the sheets are put on horizontally, nail 2″ by 4″ stretchers between the studs 4′ above the floor to form a girt for nailing the meeting edges of the plywood. Siding may be laid directly on the sheathing but insulation against heat and cold is much improved if ½″ furring strips are nailed along the studs outside the sheathing to leave an air space.

The substitution of ½″ exterior plywood for traditional siding results in labor saving and better insulation against temperature changes. Nailed over furring strips, with joints butted and calked with mastic, a flat surface is obtained. Joints can be emphasized in the design by locating them with regard to window and door openings and covering with battens or moldings.

To install lapped plywood siding over plywood sheathing, substitute wedges tapering from ½″ to 1″ for furring strips.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

Announcing *Ultramodern*

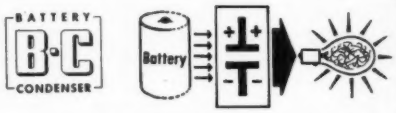
...with the versatile new Kodak Ektalux battery-condenser system

You'll find features galore in this sensational new lighting system for flash photography. Kodak Ektalux Flasholder, the basic unit, can be used alone, or with as many as six Ektalux Extension Units in perfect synchronization—B-C power from the Flasholder supplies all the energy.

Addition of the new Kodak Ektalux Solenoid permits you to use the accessory Remote Release for exposure control at a good distance from the camera.

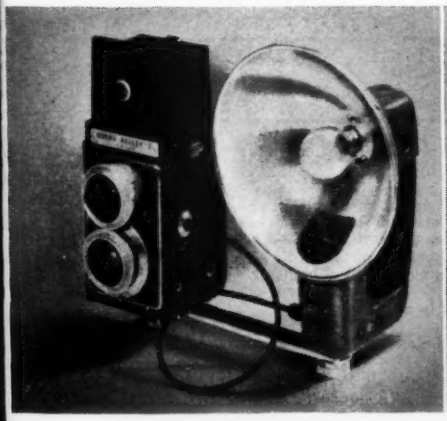
And for cameras that have non-flash shutters, you get a complete external synchronizer by adding the Solenoid and Synchro-Switch to the basic Flasholder. Choice of brackets permits quick, rigid attachment of the Flasholder to practically any type of camera.

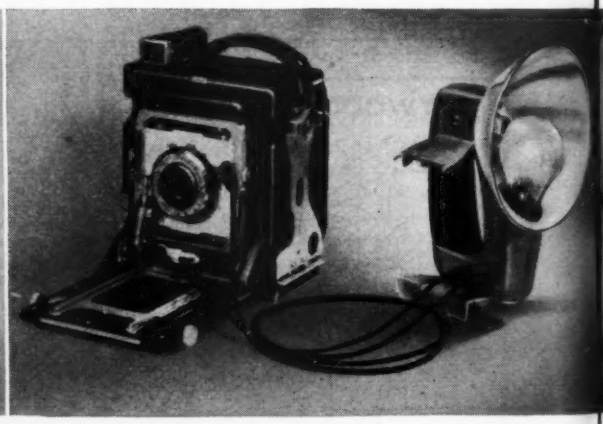
In all cases you benefit by the new pistol-grip handle...the durable, light magnesium construction. Be sure to ask your Kodak dealer to put this versatile Flasholder system through its paces. You'll be amazed.



How battery-condenser power works

The B-C system brings to the Kodak Ektalux Flasholder a revolutionary new power supply. A small 22.5-volt photoflash battery feeds power to a condenser which stores the power until needed. The condenser then fires the lamp in a single surge *15 times as strong* as the force of the usual 1.5-volt flashlight battery. This uniformly high power surge insures flash performance of far greater dependability and scope than is possible with conventional battery operation.





"Ektalux" quickly adapts to amateur or professional cameras

Use with practically any roll-film camera—Standard Bracket fits Ektalux Flasholder to most reflex, folding, or miniature cameras. For cameras that have built-in flash synchronization, no further attachments are required for this new high in dependable "flash" picture taking.

Ideal teammate for press-type cameras—By means of the Press Bracket, the Ektalux Flasholder can be fitted to most press-type cameras. Camera and Flasholder firmly lock together or detach quickly. A special bracket is also offered for the Polaroid Land Camera.

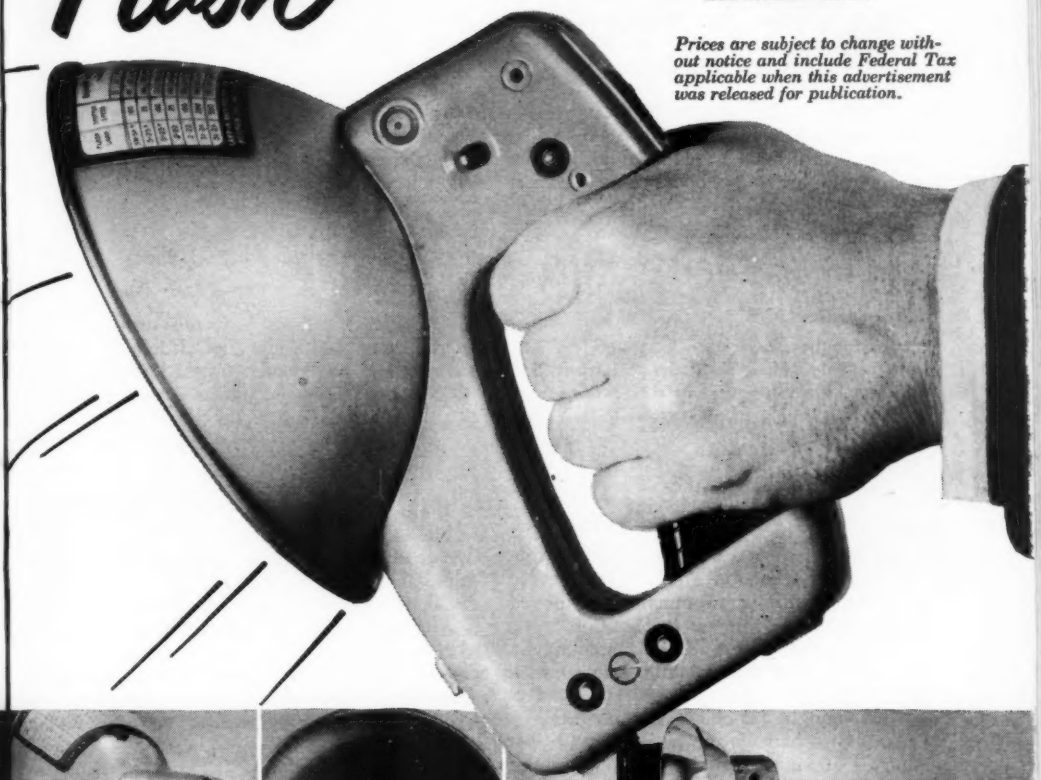
Flash

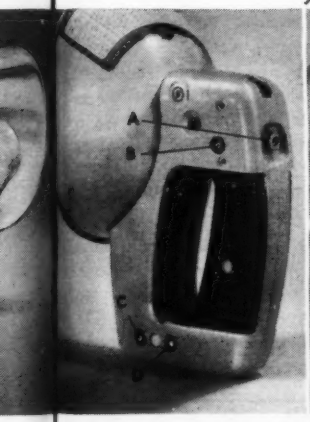
Kodak Ektalux Flasholder

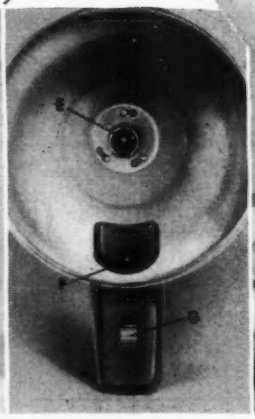
With Standard Bracket.....$34.75
With Press Bracket..... 39.50
With Bracket for Polaroid Land Camera..... 35.75

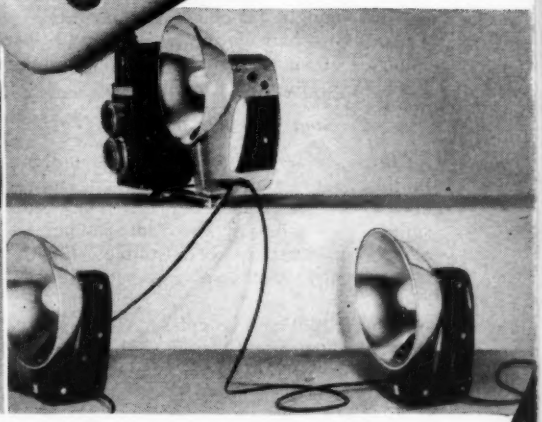
ACCESSORIES EXTRA

Prices are subject to change without notice and include Federal Tax applicable when this advertisement was released for publication.









Accessory outlets are handy—Button **A** is Solenoid release that permits tripping shutter from Flasholder. Outlet **B** accepts the Remote Release. Outlets **C** and **D** take Extension Units. The entire system is series-wired.

Lamp system is flexible—For midget lamps, note socket **E**; provides for two-way focus. Ejector is in back. **F** is socket for medium-base lamp, with its ejector **G**. A handy exposure table is on back of reflector.

Outstanding choice for multiple flash—Extension Unit cords may extend to either side of the camera. Each unit can then be hooked to another unit. Units stand steady on flat surface. Socket in base fits tripod or Clamp. Removable reflectors nest; handles stack for storage.

EASTMAN KODAK COMPANY,
ROCHESTER 4, N. Y.

Kodak

Gus and the No-Left-Turn Car

[*Continued from page 180*]

Doc Evants thought for a minute, tugging at his chin. "Are you suggesting that her protests might be the symptoms of some inherent mechanical difficulty?"

Gus nodded.

"I doubt it, but you have my permission to examine her. I'll stroll on down to Mrs. Bentley's and have a chat. I've got the first chapter on my new book, *The Inconsistencies of Human Thought*, that I'd like to show her. I'll drop back here later."

Gus Gets to Work

"What's the trouble with the old screwball's car?" Stan asked after they'd driven the sedan into the shop.

"Engine misfires on sharp left turns. I've a hunch it's either dirt in the gasoline line or a damaged carburetor float that gets stuck when centrifugal force throws it to the right on a sharp left-hand turn."

Before he checked either of these points, he got into the car, started the engine and proceeded to turn the steering wheel as far to the left as he could. He looked a little disappointed when the engine continued to purr along without so much as a missed beat. Finally, he shut off the ignition.

"What's the matter, boss? Think maybe the steering gear had something to do with it?"

"Just thought I'd check. But no luck."

And Gus had no better luck with his hunches about dirt in the gas lines or the gas tank or a faulty carburetor float.

Stan Stumbles on a Clue

"Boss, maybe the old doc's got something in this sent— sentiency stuff. You know—about cars being like humans. They sure suffer from some of the same ailments—clogged-up arteries, head troubles, breathing ailments, stiff joints, shorted nerves, and. . ."

"Son, I think you've got something there. Why the devil didn't I think of that before?" Gus all but dove in under the open hood and began to check the wiring.

After about five minutes Gus straightened up and his face was all smiles.

"Take a look at this." He pointed down at the solenoid that operated the car's overdrive, then hit it with his finger.

Stan saw that the unit was quite loose on its moorings and that the insulation on one of the heavy wires leading to it was badly frayed.

"Every time the car would swing to the left," explained Gus, "the solenoid would swing to the right and that bare spot on that wire—the one that leads to the ignition—would ground out against the car's frame. When the car was going straight or turning right it wouldn't touch the frame."

It didn't take Stan and Gus long to make the repair. Gus was just washing up when Evants walked in.

Gabriella Acts Like a Lady Now

"Well, Mr. Wilson, has your stint of research convinced you that Gabriella II was warning me not to see Mrs. Miller today?"

"No, I'm convinced it was as you would say, 'a slight inherent electrical difficulty.' But she's all fixed now and ready to go."

"Splendid, splendid. I am truly grateful. . . . I—ah—happen to be a bit short of funds at the moment," Evants went on, fumbling in his pockets without conviction, "but send me a bill, by all means. And now I must hurry along to Mrs. Miller's.

"As a matter of fact," he confided, "I have a most important question to propound to that dear lady. Now that my fears have proven unfounded, I shall proceed with confidence." And with an airy whisk of the hand, he drove briskly away.

Gus Wishes the "Doctor" Luck

"Well, I'll be darned," said Gus, "if the little doctor hasn't got matrimony on his mind—and it'll be a pretty good catch for him if he makes it, which I suspect he will."

"Gee, boss, just think," mused Stan, "if you hadn't spotted the trouble, Doc Evants would've gone right on believing Gabriella was trying to warn him, and he might never have popped the question. Well, I wish him luck."

Gus, confirmed bachelor, grinned contentedly and reached for his pipe. "Me too," he said.

END

Make Trouble Pay

Had any interesting car breakdowns lately? Gus wants to hear about your tough and tantalizing automotive problems. Write him about the false diagnoses as well as the cures. *Popular Science* will pay $25 to the first sender of each usable story idea. Letters can't be acknowledged or returned. Address: Martin Bunn, Popular Science, 353 Fourth Avenue, New York 10, N. Y.

the right step to MAKE BIG MONEY all your life!

BE YOUR OWN BOSS!

Here's the big LIFETIME OPPORTUNITY for the man who wants to get ahead in something for himself—wants to earn $35 to $50 a day—wants to *be his own boss* and keep all the profits from his own labor!

It's easy to start a floor sanding business of your own with American Machines! Thousands of men have been successful with our plan. No experience or special schooling needed. American Sanders are easy to operate, speedy, dependable. Your age makes no difference—men 18 to 80 are active in floor surfacing and make a good living.

Pleasant indoor work . . . steady all year round. Prospects everywhere . . . new and old floors. No large investment. Work out of your own home. Use passenger car for taking equipment from job to job. Easy to get jobs—business mushrooms—and *you are boss!* Send today for "money - making" booklet entitled "Opportunities in Floor Surfacing"—use coupon and enclose 25c in coin or stamps to cover handling.

SEND FOR TELL-ALL BOOKLET!

The American Floor Surfacing Machine Co.
532 So. St. Clair St.,
Toledo, Ohio

Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing", telling me how I can start my own floor sanding business.

Name.....

Street.....

City.....State.....

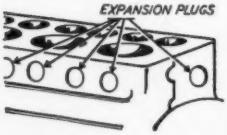
AMERICAN FLOOR MACHINES

Care and Feeding of Engines

BY S. P. CORP

PLUG YOUR LOSSES

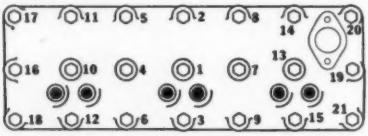
When a cylinder block is cast, large holes are provided in the side of the casting for cleaning. These holes are stopped up with plugs known as expansion plugs or Welch plugs. They are about two inches in diameter, and are forced into position to keep water from leaking out. At times they do leak, and you lose expensive anti-freeze.



To remove one of these plugs, drive a small punch into its center, which will dish the plug so it falls out. Clean the hole of all rust and dirt. Make sure new plug is free of sharp edges. Fit new plug into its seat in the engine block, curved side out, and expand it by flattening it with a blunt drift and hammer. A good sealing compound may be placed around plug before installing. Check engine for water-tightness.

MUSTN'T BE TOO TIGHT

Don't draw a cylinder head down too tight, or it may cause engine to pump oil. When checking engine head for winter operation, use a Torque wrench to make sure all cap screws and nuts are tightened evenly. Center cap screw or nut should be tightened first, then next row on each side, as in diagram.



This method will iron out the head gasket, preventing leaks and distortion. Apply 65-70 foot-pounds of pull for cap screws and 50-60 for cylinder head nuts.

IF YOUR CAR DRINKS TOO MUCH

An engine that uses too much oil needs new Sealed Power piston rings. The Sealed Power MD-50 Steel Oil Ring does the world's best job of oil control, even in badly tapered and out-of-round bores. Your dealer has Sealed Power Rings or can get them for you. They save gas, save oil, restore original power to your engine and lengthen its life. A postal to "Sealed Power, Dept. H-1, Muskegon, Mich." will bring you free a helpful book, "7 Ways to Save Oil."

His Camera Earns Over $500 a Day

[*Continued from page 195*]

2:00 A.M., worrying, he stopped to watch a photographer shoot a store-window display. As the photographer started to pack up, Richie moved in and made him a proposition. He wanted a montage of night-club signs, but he had no idea how to make it himself. If the window man would shoot it, Richie would split the profit.

Window Man Becomes Partner

Agreed, they hailed a night-owl cab and buzzed around town shooting neon signs. Later, dividing the spoils, Richie discovered that the window man was bored with windows and ached to get into greener fields. Richie annexed the window man's technical skill to his own business ability. From him, and from experience, he gradually learned basic photography—and developed a personal style that made him famous.

As you'd expect from a hyper-thyroid, Richie's style is hyper-drama. Where most photographers would use two or three lights, Richie uses a dozen. He sticks them wherever they'll reflect white hot off every metal surface back into his lens. He leaves his shadows jet black. This range of tone makes his pictures jump right out at you.

For this technique he uses compact, lightweight "RSP" bulbs, which consume only 500 watts but burn at an overvoltage that makes them give as much light as 1,500 watters. Their built-in reflectors squeeze the light into a narrow 20 degrees. They last only six hours, but while they last they can fry an egg at five feet.

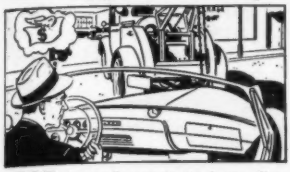
For large areas he has to use flash bulbs —sometimes $20 worth at a shot. To save the time of replacing the burned-out bulbs for a second shot (not to save another $20) he uses three or more extra cameras to get different angles, all at the first bang.

How to Pose a Locomotive

When necessary, Richie will do anything short of murder to give his client an exciting, unusual shot. General Motors wanted a dramatic picture of two Diesel locomotives in the making. Only the Diesels' rear ends were showing. Richie persuaded the plant foreman to have one of the engines turned around, to have arc welders brought into the work area, to haul up a lot of bright, shining beams to fill a dark, blank area. It took several hours of crane work

[*Continued on page 230*]

The Biggest Money Saving Idea in Car Maintenance in 20 Years

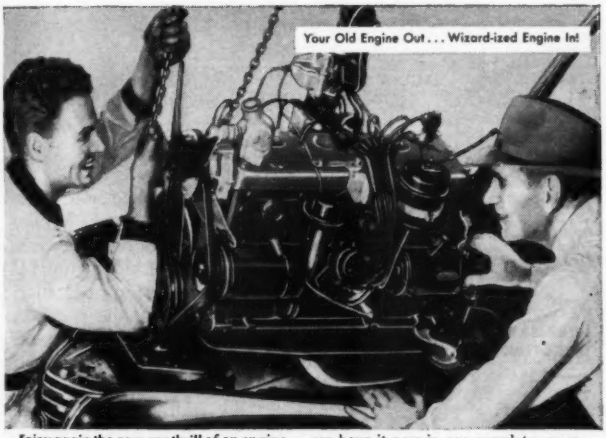


STOP those endless repairs that keep pulling $10 bills out of your pocket.

STOP expensive overhauls that still leave things undone to break down later.

STOP paying high gas, oil and maintenance bills on an unsafe, worn-out engine.

New Kind Of Replacement Engines ...Successor To Costly Overhauls!



Enjoy again the new-car thrill of an engine that's packed with surging power . . . power to level any hill . . . power to pull out of tight spots in traffic . . . power that means years of care-free driving and day after day dependability. You can have it now in one complete, guaranteed package in a Wizard-ized Engine. (Attached engine accessories are used from old engine, or may be replaced new.) Yours on easy Western Auto terms!

No Regular Overhaul At Any Price Can Match Your New Factory Remanufactured*

Wizard-ized Engine!

HERE, AT LAST, is a new kind of replacement engine for your car! . . . so much **better** than partially rebuilt engines or ordinary overhaul jobs that thousands call it the ***successor*** to costly overhauls!

"NOT A SO-CALLED "REBUILT" but completely remanufactured in 5 large factories, this Wizard-ized engine gives you an easy, low-cost way to *and* costly repair bills. And you can . . .

GET ANOTHER 50,000 OR MORE MILES from your present car! That's because...

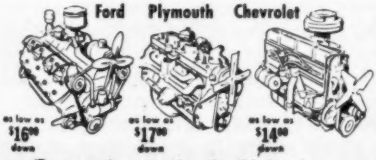
EVERY MOVING PART IS BRAND NEW top quality or fully remanufactured to function like new. Over 150 new parts. That's why you can buy with new car confidence. In fact, Western Auto gives you...

THE SAME GUARANTEE THAT COMES WITH A NEW CAR ENGINE—plus a free 500-mile service inspection of our installation. Still this Wizard-ized Engine is...

PRICED FAR BELOW THE COST OF A NEW ENGINE . . . or about the cost of a bearing, ring and rebore overhaul! Our...

INSTALLATIONS ARE MADE BY trained mechanics in fully equipped garages. So...

SEE YOUR WESTERN AUTO MAN TOMORROW . . . ask about his trade-in allowance for *your* old engine!



(Terms vary by area, make and model of car.)

GUARANTEED*
New Car Engine Performance for
Chevrolets, Fords, Plymouths, Chryslers, Pontiacs, Mercurys, Dodges, Studebakers, DeSotos, Olds and other popular makes.

Wizard-ized® Engines

FACTORY REMANUFACTURED

The Engine You Can Buy with New Car Confidence

Sold Only By **WESTERN AUTO STORES & ASSOCIATE STORES**

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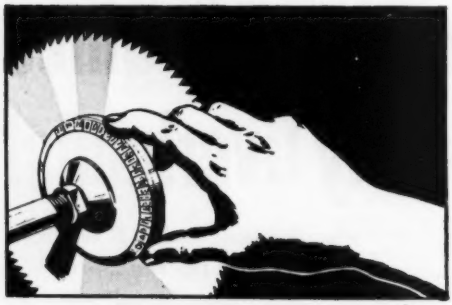
NOTE: Western Auto Associate Dealers own their own stores and set their own prices. Terms quoted are recommended terms, subject to variance. PS-12

NOW—40 different cuts with AMAZING, NEW Warren

DADO SAWING WASHERS ON YOUR SAW BLADE!



NO WARP...
NO WOBBLE...
NO BURNING!

4 WASHERS MEAN PERFECT BALANCE

Make clean, smooth parallel grooves at any angle—no chewing, no sanding. Just dial your cut—no trick screws, no vibration, strengthens blade for straight cuts. Warren Washers greatest improvement in 30 years—and most copied—look for the name on the box and washers. It costs no more to get the best—WARREN, IT'S GUARANTEED! At your dealer or order direct. Give arbor size—½", ¾", ⅝", 1"—sent postpaid.

ONLY 4.95 PER SET

WARREN DADO SAWING WASHERS CO.

Dept. 41 • Box 98, North End Station
Detroit, Michigan

His Camera Earns Over $500 a Day

[Continued from page 228]

to turn the locomotive around. Meanwhile Richie was firing away in another part of the plant. When everything was set, Richie returned, used a public-address system to spot workers in his composition, and shot a picture that has become famous.

When Richie starts a job, he finds out first thing what *idea* the client wants to get across—not what things he wants photographed. Then Richie "cases the joint" looking for subjects to illustrate the ideas.

On this "casing" tour he takes along a batch of junior executives. As he strides through the plant he gives them orders: "Paint that machine gray—here's a sample color" . . . "Have 300 hospital-clean differentials piled up in that corner" . . . "Get 50 workmen in oily clothes lined up on that staircase" . . . "I'll shoot the gray machine in half an hour, the differentials an hour later, the men on the staircase right after that."

Richie's top fees have been for pictures attempted by other photographers without success. Plymouth paid him $1,500 for just one indoor shot of endless rows of cars. They had tried it themselves and hadn't gotten enough cars in the picture.

Boeing also paid him $1,500 for a trick shot of a giant bomber being tested. While the body was held rigid, the wings were first bent far up and then far down out of normal. They wanted a superimposed shot with three wings on each side: one normal, one elevated and one depressed. The camera working space was cramped, the background was so cluttered you could hardly see the plane, and the problem of lighting the huge structure was gargantuan. That day's work, says Richie, was well worth the $1,500.

Aerial Photos Are Tricky

Richie's mobile picture factory includes a truck, station wagon and his Beechcraft Bonanza.

To shoot from the air, he throttles back to 100 miles an hour, goes into a descending turn near the CAA minimum, holds the control yoke with his knees, picks his camera off the floor and snaps a picture—two if he's quick and lucky. Then power is pushed on, the camera goes back on the floor fast, and the window is slammed shut. Richie recommends this only in calm weather.

Of late, Richie, has been doing more

[Continued on page 232]

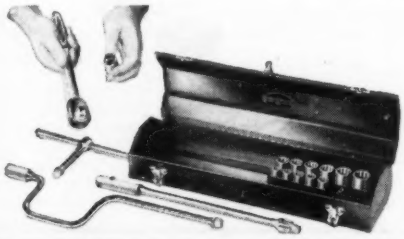
See, try, compare—you, too, will choose Westcraft Tools over all other brands

Like thousands of other tool buyers, you'll be surprised to discover how much you save by choosing famous, professional-quality Westcraft Tools. They give you the precision engineering and lasting accuracy you'd expect to find only in more expensive tools. See the complete line of guaranteed Westcraft Tools this week . . . yours on easy terms at Western Auto.

① **¼"Electric Drill,** 115 volt; AC-DC; 60 cycle. 650 RPM Chuck. Lightweight, ideal for general utility. 1-year guarantee. Only . . . (2H1379) **$11.95**

② **14-Piece Accessory Kit** for electric drill. Attachments for sanding, polishing, grinding, etc. Baked enamel steel box. Real time-saver. (2H1378) **$4.75**

③ **4-Piece Wood Bit Set,** converts ⅛" drill to bore holes up to ½" diameter and 3⅝" deep. Yours for only . . . . . (4HR6750) **$2.47**



17-Piece Socket Set, ½" Square Drive. Alloy steel, chrome plated. Complete with 12 sockets, reversible ratchet, 4 fittings. Heavy gauge steel tool box with red, baked-on enamel finish. A low-cost basic kit for mechanics, home owners, farmers. . . . . (HR2951) **$19.45**

7" Lobster Claw Plier. Patented leverage design gives 50% more gripping power, ⅜" to 1". No other like it. . . . . (HR1125) **$1.29**

Screwdriver, alloy steel, chrome-plated, 4" sq. blade. Positive-grip, shockproof plastic handle. Professional quality. (HR1361) **85¢**

Professional Quality—Wizards of Performance

WESTCRAFT TOOLS

Sold by the largest group of associated tool departments in America

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His Camera Earns Over $500 a Day

[Continued from page 230]

motion-picture work. He got his movie start when a Texas Co. official sent him off to South America. The company liked the finished film so well it ordered three more.

An Arabian Nightmare

Shooting a later film in Arabia, Richie covered 150 widely separated locations in three weeks. Daytimes he worked outdoors and nighttimes indoors, sometimes shooting around the clock. As a sequel to that expedition, Richie received a cable one morning from the King of Arabia asking him to come over and make some portraits as quickly as possible. Richie and his office—which occupies an entire floor in a Manhattan building—dropped everything, and 24 hours later he was off on a plane for Jidda with $900 in excess baggage consisting of cameras, film and 5,000-watt spotlights.

Richie made $7,500 worth of portraits in black and white and in color of the King and his court. Then to save the $900 for excess baggage on the return trip he sold all his heavy equipment to the Arabian American Oil Co.'s film department.

Despite the Scotch in his blood, Richie's thyroid is not stimulated solely by the clink of one coin against another. Only a man's love for his work would make him so willing to risk his life to catch just the right angle for a shot.

How to Shred a Photographer

In British Columbia, for example, Richie was filming a machine that chewed up big logs in a matter of seconds. The view from the top of the chute where the logs dropped in was fair, but not quite what he wanted. If he could only get a real close-up of the knives that tore the wood to shreds . . .

Richie grabbed a small movie camera, ordered two of the huskiest assistants to hold him by the legs and lower him down the chute. Then, his finger on the camera button, he gave the order and a half-ton log shot down the chute a few inches from his stomach and into the whirling knives. To the company official who called him crazy when he heard of the exploit, Richie replied casually: "I had it set so I'd go head first if anything gave way." END

UNCLE WALTER

IT SMELLS GRAND

HAS IT GOT AROMA? MAN, AND HOW!

IT PACKS RIGHT

AND IT PACKS SO NEAT IT RATES A BOW

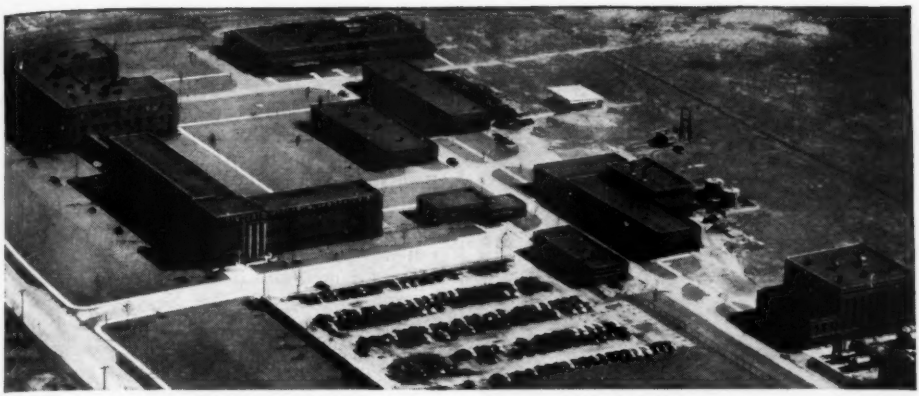
IT SMOKES SWEET

IT'S THE PIPE-BLEND CHAMP YOU MUST ALLOW

IT CAN'T BITE!

A BLEND OF CHOICE KENTUCKY BURLEYS, EXTRA-AGED TO GUARD AGAINST TONGUE BITE. SIR WALTER RALEIGH STAYS LIT TO THE LAST PUFF — NEVER LEAVES A SOGGY HEEL.

It costs no more to get the Best!



SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, production and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors who have no such facilities within their reach.

An Offer of Research Facilities To Inventive Americans Who Need Them

The Sinclair Plan is opening up the Company's great laboratories to every American who has an idea for a better petroleum product

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for large and expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square homemade "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a supersonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Under the Plan, Sinclair has *no control* over the inventor's sale of his idea to others, and has *no participation* in any of the inventor's profits through such dealings. Moreover, it is a competitive characteristic of the oil business that the new products adopted by one company are almost invariably adopted by the whole industry. This means that the very fact of his agreement with Sinclair should open up to the inventor commercial opportunities which might otherwise be hard to find.

How to proceed: Instructions on how to submit ideas under the Sinclair Plan are contained in an Inventor's Booklet available on request. Write to: W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 600 Fifth Avenue, New York 20, N. Y. for your copy.

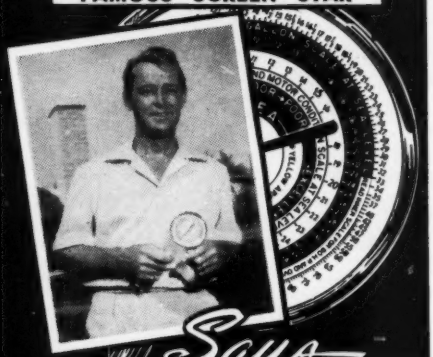
IMPORTANT: *Please do not send in any ideas until you have sent for and received the instructions.*

SINCLAIR

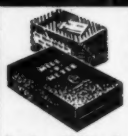
A Great Name in Oil

Alan Ladd

FAMOUS SCREEN STAR



Says...



Each "Mile-O-Meter" is beautifully gift wrapped.

24 page instruction manual and Scientific Calculator included.

Precision built by Gauge Craftsmen.

"Out here in L.A. everything's so spread out that we seem to spend half our lives in the car, and it gets mighty expensive.

I sure was thrilled to find this "Mile-O-Meter", a gauge to measure miles per gallon and motor tune-up of our auto. Also checks spark plugs, carburetor and 31 motor adjustments."

Why not follow Alan Ladd, and purchase a "Mile-O-Meter" today. No car is complete without one — shows you how to save gas and check your entire engine. Simple to install — no experience necessary. 4 color dial — a precision instrument.

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DELUXE CHROME MODEL 3½" Dia. ..... $14.95 Ppd.
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(Both include Fed. Tax)

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Makes a perfect gift MONEY BACK GUARANTEE

Jackpots in Suggestion Boxes

[*Continued from page 127*]

General Motors alone has paid out $6,366,198 in prizes since 1942. No less than 775 employees took home the company's top cash award of $1,000. Recently the top was shoved up to $2,500 and five people have won it so far. In 10 years GM employees have submitted 704,797 suggestions, and 159,220 of these won prizes and were put into operation.

Government also is a big operator in the suggestion business. The Navy and Army Ordnance suggestion systems date back to World War I. Although the law extending the practice to all Federal agencies was not passed until 1946, the Budget Bureau estimates that the savings to the Federal Government from employee ideas have exceeded $50,000,000 in the last three years. The Navy claims to have saved $66,000,000 in two years' operation of its system during the last war, and the Army $100,000,000!

Idea Saves Navy $23,000,000

One suggestion alone saved $23,000,000 in the first year by cutting the cost of fuses for 40-mm. shells from $1.26 to 37 cents. It earned $5,550 for the suggester, Raymond L. Graumann, a civilian engineer at the Washington Navy Yard.

Suggestion systems are spreading rapidly to other countries. A Swedish delegation brought here by the U.S. Economic Cooperation Administration recently conducted a study of American methods. Many Canadian companies have suggestion organizations. Canadian Westinghouse has given out nearly $100,000 in the last eight years on more than 6,500 suggestions.

Diemaker's Invention Saves Time

A 37-year-old diemaker at Canadian Westinghouse named Joe Orme caused a mild sensation not long ago with a small drill he had developed and then carried around in his toolbox, almost forgotten. One day Jim was asked to repair a die that would probably suffer severe damage if the ordinary annealing process were used. He tried his drill, and in a matter of minutes it did a job that would ordinarily have taken hours—if it could have been done at all.

After a dozen demonstrations, Jim decided the drill was worth reporting to the company's suggestion committee. "One of my pals got $50 for an idea," he explained,

[*Continued on page 236*]

Popular Files for the Home Workshop

NICHOLSON U.S.A.

BLACK DIAMOND TRADE MARK

Any reasonable poll or survey will show Nicholson and Black Diamond files the first choice among top mechanics. You'll find these world-famous files in pattern, toolmakers and fine-instrument shops—where precision filing is highly essential. . . . In industrial plants where fast filing is a production "must." . . . In home workshops where fine tools as well as fine accomplishments are owners' pride.

Whatever the requirement, the superiority of Nicholson and Black Diamond files shows up in results—through correct design, accurate cut, proper hardening, uniformity, and maximum wear. Shown here are some of the types most widely carried by hardware and industrial supply houses in popular lengths and range of coarseness. They represent a practical home workshop assortment toward having on hand The right file for the job, saving time and materials, and improving work.

(1) **MILL** – for smoothing, edge-sharpening, large-tooth-saw filing.

(2) **TAPER** – Regular, Slim, Extra Slim, Double Extra Slim – for small-tooth-saw and other delicate filing.

(3) **FLAT** (4) **HALF ROUND** (5) **ROUND** (6) **SQUARE** (7) **PILLAR** (8) **KNIFE** (9) **THREE SQUARE.** Mostly double-cut – for fast stock removal.

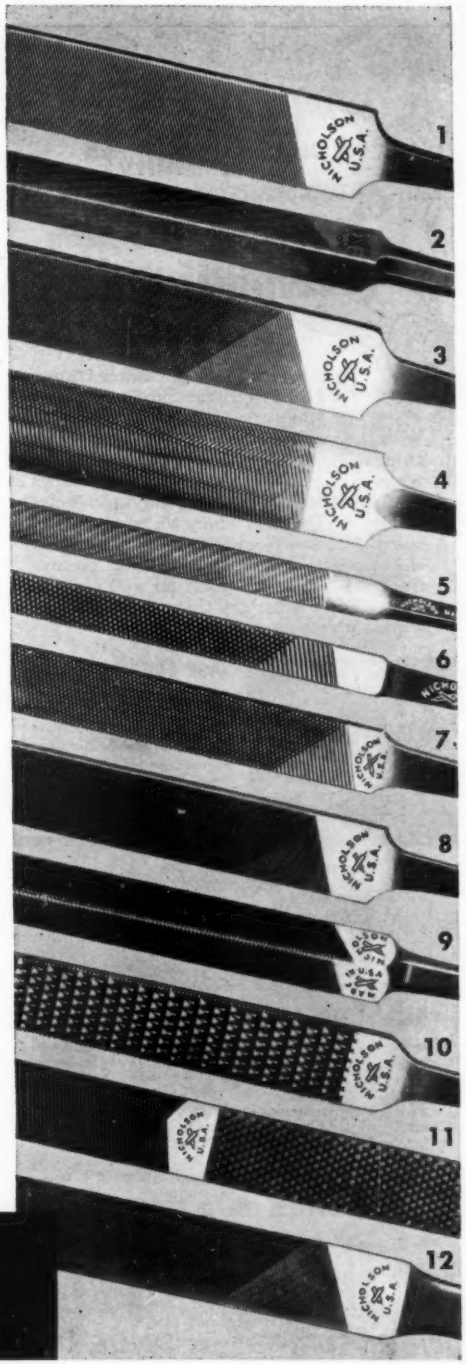
(10) **WOOD RASP** – flat and half round types, for woodworking.

(11) **SHOE RASP** – with many uses, on wood, metal, plastics, etc., as well as leather. Half round; half of each side rasp cut, other half file cut.

(12) **HANDY FILE** – with forged-on handle; two types of cut – single on one side, double on other.

FREE BOOK, "File Filosophy," *on kinds, use and care of files . . . 48 interesting, illustrated pages. Write to –*

NICHOLSON FILE CO.
19 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)



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Take advantage of your HOME-UTILITY Tool's amazing versatility!

buy HOME-UTILITY accessories

RECEIVE a Black & Decker Home-Utility Drill or Sander-Polisher for Christmas? Pleased as punch with the way it helps you build and repair things? Then you're in for more good news when you discover how many more times useful you can make it by buying Home-Utility accessories! There's a whole raft of them to choose from—for everything from sharpening knives and making picture frames to polishing your car and shining up pots and pans. Try them at your hardware, appliance or department store!

Disc Sanding Table only $7.75

Ideal for rapid, accurate sanding of picture molding, plastics and hobby parts. Easily handles small, odd-shaped, curved pieces.

Roto-Hone Attachment only $10.95

Hones knives, chisels, plane bits, lathe tools to razor edge. Clamp and guide bar for accurate angle. Stone has rough and fine sides.

PLUS stands, auger bits, masonry bits, countersinks, wire wheel and cup brushes, sanding discs, lambswool bonnets, auto polish, electric wax, saw blades, protractors, etc. THE BLACK & DECKER MFG. CO., Dept. H1S, Towson 4, Md.

BLACK & DECKER

ELECTRIC HOME-UTILITY TOOLS

DRILLS • SANDER-POLISHERS • LECTRO-SAWS

Jackpots in Suggestion Boxes

[Continued from page 234]

"and I thought I might make a few bucks too." The committee awarded Jim $850.

So widespread have suggestion systems become that a National Association of Suggestion Systems has sprung up which already has 475 members. It issues a publication devoted largely to suggestions for getting suggestions.

Most companies pay off on a basis of 10 to 50 percent of the savings made in the first year's operation of the new suggestion. And most of them continue to pay off on the savings of succeeding years.

Some Companies Pay in Merchandise

Some set a maximum—usually $1,000—on the theory that a set amount is a better incentive than a nebulous percentage of unknown future proceeds. Minimums usually run between $5 and $25. A few companies pay off in stock, some use merchandise awards. Many hold contests in which they give out radios, refrigerators and even automobiles.

Big companies have made it so easy to turn in ideas that most employees find it hard to resist. Suggestion forms are provided, and about all you have to do is fill in the blanks. Most companies require that the suggestion tell not only what is to be done but also give a reasonable description of how to do it.

Appearances Don't Count

"Don't worry about spelling, grammar, punctuation or appearance," says the General Motors employee-suggestion manual. "All that counts is the idea."

Committee representatives pick up the suggestions regularly, notify the sender that his idea is in the works and send it along to a committee of specialists—representatives of management, engineering, tool design, cost accounting and manufacturing.

These committees, in the words of one company, "lean over backwards to see that every suggestion receives unbiased treatment." They are usually looking for points in favor of each suggestion, not trying to knock it down.

"We're just as anxious to pay awards as you are to get them," one company assures its employees. END

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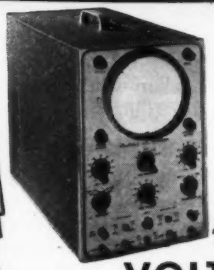
PROFESSIONAL QUALITY RADIO and LABORATORY INSTRUMENTS IN KIT FORM

SAVE 2/3 THE COST

GAIN VALUABLE KNOWLEDGE

HAVE A COMPLETE LABORATORY FOR A FEW HUNDRED DOLLARS

BUILD OSCILLOSCOPES V.T. VOLTMETERS SIGNAL GENERATORS AMPLIFIERS . . . BRIDGES and 20 Other Instruments



Heathkit 5" OSCILLOSCOPE KIT

A laboratory quality oscilloscope 5" cathode-ray tube — every part supplied including instructions for operation and assembly. Includes ten tubes — all controls — high gain .03 Volt RMS per inch vertical sensitivity useful to 5 Mc. An outstanding buy. Shipping weight, 29 lbs. — Model O-7

$43.50

Heathkit VACUUM TUBE VOLTMETER KIT

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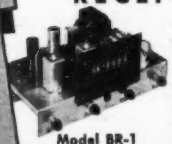
Heathkit SUPERHETERODYNE RECEIVER KIT



Model BR-1
Shipping Wt. 11 lbs.

$19.50

A high quality AC operated superheterodyne receiver in kit form. Complete with five tubes — six inch slide rule dial — all coils — transformers and ready punched chassis and instructions. Learn about radio by building this outstanding receiver.

Heathkit 6 WATT ECONOMY AMPLIFIER KIT

Model A-4
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$12.50

A powerful 6 watt amplifier kit. Complete with tubes — transformers and all parts. Use it for music reproduction — public address system — factory call — school dances, etc. Easily assembled. Rent it in your community and it will quickly pay for itself.

Easy STEP BY STEP INSTRUCTIONS WITH PICTORIAL DIAGRAMS . . . MAKE ASSEMBLY EASY FOR ANYONE.
All metal parts ready punched. Only pliers, screwdriver and soldering iron needed for assembly.

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First for fine work!

There's one point on which all mechanics agree—Stanley Tools are first for fine work. That's why you'll see these Stanley Tools in the tool chests of skilled woodworkers everywhere. Accuracy and easy action make these tools perfect partners for fine workmanship. Look for this famous STANLEY at your hardware dealer's. It's the sign of top quality tools.

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Green ends. Large, easy-to-read numerals. New protective plastic finish. 6' and 8' sizes.

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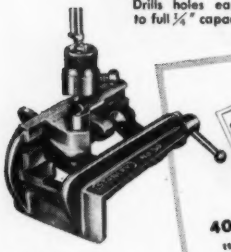

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For boring holes accurately and easily in the edge, end or surface of boards. Furnished with depth gauge and six guides — 5/16, ¼, 5/16, 3/8, 7/16, ½".

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How a One-Armed Bandit Works

[*Continued from page 93*]

slot machines. On the basis of Federal tax returns, it is estimated that more than 200,000 slots were operating in 1949. Each of these made a profit of perhaps $50 a week, or around $2,600 a year. That would make a gross profit for the industry that year of about $520,000,000. Figuring that there were many more machines whose operators paid no tax, the California Crime Study Commission set the national gross at two billion a year. That allows a very tidy profit, when you remember that slot machines are illegal in 43 of the 48 states.

Profits Pay for Bribes

How do the 175-odd distributors and 10,000 operators who compose the slot-machine industry get away with it? Some slots of course are in clubs or private homes were police are loath to interfere. But most slots get by for two reasons: a community is either indifferent or thinks that slots bring business; or local officials or police are bribed to ignore the machines. Experts of the California Crime Study Commission figure that 10 to 20 percent of the gross profits go to corrupt law enforcement.

But times are changing. In Idaho, for example, which had passed an act legalizing slot machines on a local-option basis, several cities revoked all licenses after a couple of years' trial. The city commission of one of these communities, Twin Falls, is described in testimony before a Congressional committee as reporting that licensed slot machines resulted in an increase of armed robberies and a rise in relief applicants.

Can't Gamble to Prosperity

As an added argument, Twin Falls businessmen are said to have reported an increase in overdue accounts. In 1949, Governor C. A. Robins asked the legislature to repeal the license law, stating that "Idaho cannot gamble itself into prosperity."

Lately many communities and states have been cracking down. Wisconsin and Minnesota, notably, have passed new statutes credited with putting the one-armed bandits out of business. And Uncle Sam has gotten into the act with passage of a Federal law that forbids interstate shipment of slot machines or parts except to the few states where they are legal. Several manufacturers are reported going out of business or turning to legal vending machines. END

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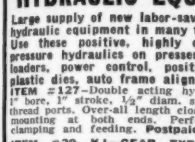
HEAVY DUTY—AIRCRAFT QUALITY

HYDRAULIC EQUIPMENT

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #127—Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/4" tubing thread ports. Over-all length closed—6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. **Postpaid**..... **5.95**

ITEM #29 KJ—GEAR TYPE HYDRAULIC PUMP. Ideal in Industrial Applications and for operating all hydraulically powered farm implements, including loaders, starkers, swathers, plows, etc. Delivers 1,000 PSI, (may be set at lower PSI if desired) 12 GPM @ 400 RPM. Maximum operating speed 800 RPM—rotation counter clockwise. Has built in relief valve, permanent or torque bar mounting, 1" diam. shaft, 3/4" pipe tap inlet, 1/2" pipe tap outlet. Shipping weight 22 lbs. F.O.B. Chicago... **45.50**



Item #29

ITEM #16 C—Double acting hydraulic cylinder, 1 1/2" bore, 25" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 16. A $55.00 value. Now Only, **Postpaid**.. **16.95**

Item #126—Four-way, open center control valve with built-in adjustable relief valve. Factory set at 1000 PSI., spring-loaded neutral position for use with one double-acting cylinder. Fully balanced plunger type, smooth, positive, easy operation, can be used as single unit or mounted in series of any combinations desired. Has 3/8" pipe thread inlet and outlet, 1/2" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 80 lbs. An outstanding Buy! F.O.B. Chicago **21.50**

Item #126

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam. shaft, 3/8" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago..... **21.50**

Item #42

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/4" stainless steel shaft. Gov't. acq. cost. $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago... **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An Excellent Buy for..... **32.50**

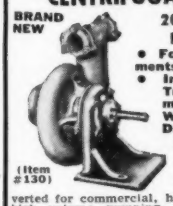
General Motors — Allison

CENTRIFUGAL PUMP

BRAND NEW

200 GALLONS PER MINUTE

- **For Draining Basements**
- **Fire-Fighting**
- **Irrigation**
- **Fuel Transfer**
- **Swimming Pools**
- **Home Water Systems**
- **Dewatering**



(Item #130)

This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/4" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. **NOW ONLY** **39.50** F.O.B. Chgo.

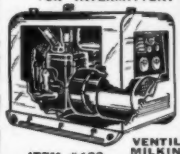
Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

PREPARE NOW FOR POWER FAILURE!
Immediate Delivery — Large Stock — Many Sizes

GENERATING PLANTS

DESIGNED FOR CONTINUOUS OR INTERMITTENT SERVICE

PLENTY OF CURRENT TO OPERATE YOUR —• OIL BURNER • REFRIGERATOR • HOME FREEZER • SUMP PUMP • POWER SAW • BROODER • CREAM SEPARATOR • INCUBATOR • VENTILATING FANS • MILKING MACHINES • BLOWERS • YARD LIGHTING • OTHER APPLIANCES



ITEM #133

Item #133—3 KW—120 Volt—60 Cycle A.C. Single Phase HEAVY DUTY

Totally enclosed power unit with 2 cylinder water-cooled Hercules Model BXB engine direct coupled to generator. Magneto ignition, crank start, 4 gallon gas tank, 3 qt. oil capacity. Skid mounted with handrails for carrying. Instrument panel including killer button, oil pressure, water temp. gauges, voltmeter, ammeter. Shipping wt. 560 lbs. F.O.B. Chicago..... **395.00**

Item #178—350 watt—110 volt—60 cycle A.C. direct coupled to 1 cylinder Midco engine. Shpg. Wt. 116 lbs. F.O.B. Chicago.. **125.00**

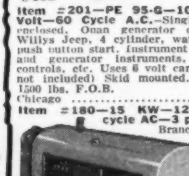
Item #178

Item #182—Onan Generator-5KW—120/240 volt—60 cycle A.C. single phase, direct coupled to Willy's Jeep 4 cylinder, water cooled engine with push button start, battery ignition. (Battery not included.) Shpg. Wt. 1200 lbs. F.O.B. Chicago. **795.00**

Item #182

Item #201—PE 95-G—10 KW—110/220 Volt—60 Cycle A.C.—Single Phase. Totally enclosed, Onan generator direct coupled to Willys Jeep, 4 cylinder, water cooled engine, push button start. Instrument panel with engine and generator instruments, circuit breaker, controls, etc. Uses 6 volt car battery. (Battery not included) Skid mounted. Shipping weight 1500 lbs. F.O.B. Chicago **1295.00**

Item #180—15 KW—127/220 volt—60 cycle AC—3 phase 1800 RPM. Brance & Krachy Generator direct coupled to International Harvester 4 cylinder, water-cooled engine with magneto ignition—push button start. Panel has voltmeter, ammeter, 4-wire electrical system, belt driven excitor generator, rheostat voltage control. Engine and generator mounted on steel skids. Shipping weight 2000 lbs. F.O.B. Chicago.... **1650.00**



Item #180

Item #128—25 KVA-250 volt, 3 phase-120 volt, Single phase—60 cycle. Totally enclosed-Hobart generator driven by a GMC 270, 6 cylinder gas engine, button start, liquid cooled. Has control panel with full set of instruments for both engine and generator. Shipping weight 2500 lbs. F.O.B. Chicago. **2250.00**

Item #128

Write for information on other size generating plants ranging from 350 watts to 25 KVA.

FREE: NEW 1952, 48-PAGE CATALOG

New Model 353—Dual Range

ARC WELDER

for Stationary or Portable Use
HEAVY DUTY RANGE TO 250 AMPS.
NEW 'MAGIC TERMINAL' FOR LOW CURRENT 30 TO 100 AMPS.
IDEAL for:

- **FARM • GARAGE**
- **FACTORY**
- **WORKSHOP**

Welds Anything From Auto Fenders To Tractor Frames

These precision engineered D.C. Arc Welders contain the highest quality War Surplus aircraft components built to exacting government specifications. They are light in weight, have oversized lifetime grease-sealed ball bearings, air cooled commutator, dial type rheostat for easy pin-point control, a high-low rheostat switch, reactor coil for even arc and the new 'MAGIC TERMINAL' low current welding range for welding lighter materials. Designed for many years of trouble-free service. Run welder from drive pulley or power take off of a tractor or Jeep, 7½ HP electric motor or 10 HP gas engine at 2500 R.P.M. Uses two V belts or flat belt. Continuous output rating 200 amps. Intermittent welding rating 250 amps. This sensational price includes double V or flat belt pulley and complete operating instructions. Shipping weight 107 lbs. $350.00 Value **Item #65** Now Only... **119.50** F.O.B. Chicago

D.C. GENERATORS

For welders, plating, truck and marine use. D. C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov.t Acq. Cost $300.00. Shpg. wt. 53 lbs. F.O.B. Chicago..... **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heints. Gov't Acq. Cost $380.00. Shpg. wt. 59 lbs. F.O.B. Chicago. Each individually packed in wooden box..... **35.00**

HYDRAULIC SPEED REDUCER

WITH FINGERTIP CONTROL
(Item #115)

USE FOR:
- **Reamer Drives**
- **Cider Mills**
- **Feed Mills**
- **Canning Machines**
- **Conveyors**
- **Lathes**
- **Milling Machines**
- **Motor Boats**
- **Cream Separators**
- **Garden Tractors**
- **Pumps**

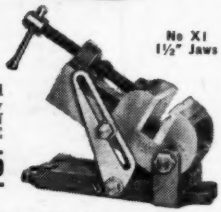
Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 3/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Over-all dimensions 7 1/2" x 7 1/2" x 11 1/2". Gov't acquisition cost. $428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

ORDER DIRECT FROM AD — SEND PAYMENT OR PURCHASE ORDER TODAY — SATISFACTION GUARANTEED

GROBAN SUPPLY CO. 1139 SO. WABASH AVE., CHICAGO 5, ILL. DEPT. PS-1.

PALMGREN
HOBB-E TOOLS

ANGLE VISE


No X1
1½" Jaws

Set up hard angle jobs in 5 seconds. Drill, grind, mill round, square or irregular pieces quickly and accurately. Save time, money and errors. PALMGREN "Hobb-E" ANGLE VISE has 1½" Jaws, 1 Plain 1 Grooved. Accurately machined and graduated. No. X1 only **$4.95**

ROTARY INDEX MILLING TABLE

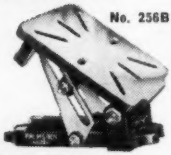
Turn drill press into vertical miller. Mill, Grind, Index Rabbet, Mortise and Rout curved or straight PALMGREN "Hobb-E" ROTARY TABLE is a precision machine, accurately graduated. Bolts to table.

No. 83

No. 83—8" Table 4" Cross Feeds, 360° Rotary Feed **$54.50**

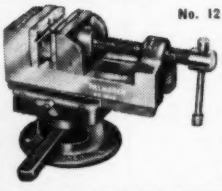
No. 82—Without Rotary Feed.... **$43.75**

ADJUSTABLE ANGLE PLATE


No. 256B

Every Hobbyist should have one for jobs difficult to hold in vise. No delay, less spoilage on complicated angles in drilling, milling, grinding or layout work. No. 256 B has 6" x 6" surface plate, 8 bolt slots. Adjustable to full 90°. Accurate graduations. Swivel Base. Only **$14.35**

BENCH DRILL PRESS VISE


No. 12

A fine "Hobb-E" tool. Base bolts to work bench for general work. Vise is dovetailed and removable for use on drill press by loosening thumb screw. Unit rotates 360° horizontally. Adapter has steel jib which locks vise in position. No. 12 Removable Jaws 2½" wide. 1 Plain 1 Grooved. Only..... **$12.95**

ALL PURPOSE ALUMINUM HAND VISE

No. 15

This "Hobb-E" tool grips small pieces for grinding, buffing and 101 other uses. Safe-guards hands and fingers. Small parts easier and faster to handle with better results. No. 15 Jaws 1½" accurately machined, can't mar work. Only..... **$2.15**

ORDER NOW! SEND COUPON TODAY!

CHICAGO TOOL & ENGINEERING CO.,
8397 South Chicago Ave., Chicago 17, Ill.

Enclosed find _____ for items checked below.
☐ PALMGREN "Hobb-E" ANGLE VISE. ☐ PALMGREN "Hobb-E" ANGLE PLATE. ☐ PALMGREN "Hobb-E" MILLING TABLE. ☐ PALMGREN "Hobb-E" HAND VISE. ☐ PALMGREN "Hobb-E" BENCH DRILL PRESS VISE. ☐ Send Circular.

NAME _____

ADDRESS _____

TOWN _____ ZONE _____ STATE _____

America's New Light Car

[*Continued from page 120*]

Moreover, the type of drive used, the Hotchkiss, transmits propulsive power from the rear wheels through the car springs, instead of through the propeller-shaft housing, the way a torque-tube drive does.

Vibration is inevitable in a car's power train. Variations of engine power cause the pinion gear in the differential to try to climb the ring gear. An oscillation develops around the ring gear's center. The principal reaction points with a Hotchkiss drive—insofar as passenger comfort is concerned—are the front eyes of the rear springs.

Rubber Absorbs Shocks

Willys solved the problem by attaching the spring eyes through live rubber to a "floating" cross member. That, in turn, is mounted in rubber where it attaches to the body. The rubber swallows and digests any shudders before they can reach the seats.

The ride, as the boss man had demanded, was superb. The Aero trod washboard as though it were glass-smooth. The pitch on hard bumps was scarcely noticeable. It took right-angle flat turns at 45 miles an hour without evident sway. That was due to a center of gravity only 23 inches above road level, the lowest of any six-passenger car in its price class.

The braking was exceptional. From an indicated speed of 60, the car came to a full stop in 156 feet. While the brakes were applied hard enough to make the rubber squeal, the shoes did not grab.

The noise level at 75 miles an hour with the vents closed was so low that the driver could hear a passenger in the back seat snapping a cigarette lighter closed. At 10 miles an hour a faint tappet noise did develop. A Willys representative said that was a matter of adjustment.

"Nearest Thing to Flying"

The driver's view of the road was equal to or better than that offered by any other car it has been our pleasure to drive. A low hood helps. Another nice feature is fenders so high that the driver can see all four.

The names that Willys has given two versions of its new car, Aero Ace and Aero Wing, didn't strike us as very imaginative. "Why," we asked Canaday, "the Aero?"

"Because," he countered, "it's the nearest thing to flying you'll find on the highway."

He may have something there! END

CHOOSE THE MODEL BEST FOR YOU!

Two DREMEL Electric SANDERS with STRAIGHT LINE Action for Guaranteed SCRATCH-FREE Surfaces

Perfect answers to any sanding problem, both Models feature: **Only 2 moving parts; 14,400 strokes per min., easy one-hand operation; dust-proof—foolproof; 10-second paper change; 110-120 V., 60 cycle A.C. PLUS—straight-line action for mirror-smooth finishes.** ***Don't settle for less!***

MODEL 2000 FOR HEAVY DUTY CRAFT AND WOODWORKING PROJECTS—Fastest seller in the field for rugged power and smoothest finishes at lowest cost. Ample power for furniture and cabinet making, boat building or refinishing, resurfacing large areas. Great for building operations—woodwork, stairs, dry-wall joints, siding, etc. Does a superb polishing job! Weighs 5 lbs; 21 sq. in. of sanding surface; over-all size 3⅛" x 4½" x 7". *Price includes steel carrying case, 25 asst'd. abrasive sheets, and a sheepskin pad.*

MODEL "A" FOR HOBBIES, REFINISHING, RE-DECORATING—Finest sander ever offered housewives, home-owners, hobbyists. A lighter-capacity model for woodwork, unfinished furniture, hobby shop projects, etc. Wonderful for polishing waxed surfaces. Also a soothing massager! Weighs only 2½ lbs. Sanding pad 2¼" x 5½". Price includes 6 sandpapers, 1 sheepskin, 1 felt pad.

MODEL 2000
$24.50

14,400 SANDING STROKES PER MIN.

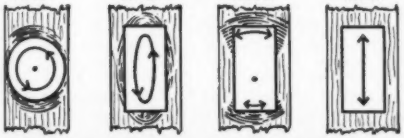
MODEL "A"
$14.85

ONLY STRAIGHT-LINE ACTION . . .
SANDS WITH THE GRAIN — NEVER MARS OR SCRATCHES

Don't just take our word for it. Ask any professional woodworker about sanding action. He will tell you that only straight-line, with-the-grain sanding can produce a flaw-less finish.

BEFORE YOU BUY ANY SANDER . . . COMPARE!

ROTARY Action | ORBITAL Action | ARC Action | STRAIGHT-LINE Action

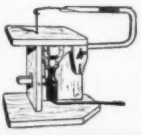


DREMEL Electric COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

MAKE YOUR OWN JIG SAW PLANS FREE!

JUST GUIDE IT! SAFE! AS A HANDSAW



For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, never needs oiling. Uses 110-120 V., A.C. Free plans, packed with each saw, for six useful woodworking projects and for making your own jig saw.

GRINDS • CARVES • ENGRAVES
DRILLS • ROUTS • SHARPENS

DREMEL Electric MOTO-TOOL

FASTEST MOST POWERFUL TOOL In Its Class—Approx. 27,000 R. P. M.

Most practical tool a man can own—more powerful than any similar tool you can buy. Works well in wood, plastics, and metal. For home maintenance jobs you'll wonder how you got along without it. For model making it's a **must.** And for general shop operations it saves time and money. Compare it, try it, buy it. You be the judge!

CHECK THESE IMPORTANT FEATURES—Oilless sealed bearings • Dynamically balanced armature • Shock-proof, Bakelite housing • Dust-filtered air cooling system • Sturdy 110-120 V., A.C.-D.C. motor • Wt. only 13 oz. • **A precision tool widely used in industry for many years.**

MOTO-TOOL NO. 2
(with 1 emery wheel point)
$16.50

MOTO-TOOL KIT NO. 2
With 23 Accessories (High-Speed Steel Cutters, Grinding Wheels, Polishers)
$23.50

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WHY PUT UP WITH THIS

WHEN YOU CAN START LIKE THIS

Easier starting in any kind of weather

BUY THE SENSATIONAL NEW Redi-Warm TRADE MARK AUTOMATIC ENGINE TENDER

FOURTEEN VITAL POINTS PROTECTED

Write for Redi-Warm FREE Booklet With Pictures

Redi-Warm, a simple thermostatic unit has complete safety controls. It is easily installed on any engine head bolt or manifold stud.

Redi-Warm assures your engine of very close to "heated garage protection" or even better, because you have Redi-Warm protection with you wherever you may drive.

Redi-Warm helps protect you even in blizzards and sub-zero weather.

Now you can buy engine tending "like a baby sitter" or "a mother's care."

Helps keep 14 vital points warm by actually cranking up the engine — and automatically — whenever it needs warming up.

Redi-Warm care is the truly natural care. It uses only the natural, internally, self-generated heat from the very heart of the engine.

No half-way measures! No plug in monkey business!

Avoid possible damage or warpage due to mere fragmentary heat applied only in spots! Reduce sludging!

Still some openings for salesmen, agents and distributors.

MAIN UNIT

NEUTRAL SWITCH

DASH SWITCH

ORDER TODAY only $24.95 postpaid

- KEEPS ENGINE ALWAYS AT STARTING TEMPERATURE REGARDLESS OF WEATHER.
- CAR CANNOT BE STARTED WHILE REDI-WARM IS SET FOR OPERATION; THIEF-PROOF — FOOL-PROOF DOUBLES BATTERY LIFE.
- SAVES WEAR ON ENGINE; SAVES GAS ORDINARILY USED IN CHOKING.
- SAVES TIME — SAVES TEMPER — ELIMINATES COSTLY TOWING CHARGES.
- PAYS FOR ITSELF OVER AND OVER.

Agents Wanted

CRAY-LINCOLN *Eng. & Mfg. Co., Inc.*

Cray Oil Bldg., North Walpole, N.H., U.S.A.

Trouble Is Their Pastime

[*Continued from page 98*]

its matchstick legs, was a brand-new calf.

More unusual yet, in the realm of aerial animal rescues, was the exploit of a Colorado CAP pilot who spied a horse imprisoned in a canyon by snowdrifts. Every day for two weeks he flew in a load of hay and dropped it close enough for the horse to reach, finally attaining such accuracy, as he liked to tell his buddies, that "that danged horse only has to open his mouth to catch dinner on the fly."

Fight Weather and Winds

Out West is where the CAP's aerial bird dogs get their most arduous workouts. The number of lost planes is high, for distances are great and the weather as undependable as a dictator's promise.

It takes a low-flying, slow-flying aircraft to do the job of searching when CAP wires buzz: "Plane overdue—presumed lost." The fussy little back-yard grasshoppers squirm through narrow canyons on one wingtip, drag wooded hillsides and hedgehop across low mountains and mesas, close enough to the ground to pick up the smallest clues.

Yet the eagle eyes of the Sunday pilots can be a source of irritation. During a CAP search for a lost ship, 20 different airplanes buzzed one ranch. At last, the nettled rancher called the nearest airport and demanded to be let alone. He explained that those shiny bits of equipment laid out on the ground, attracting the attention of every passing searcher, weren't pieces of busted-up airplane. They were the parts of a new windmill he was assembling.

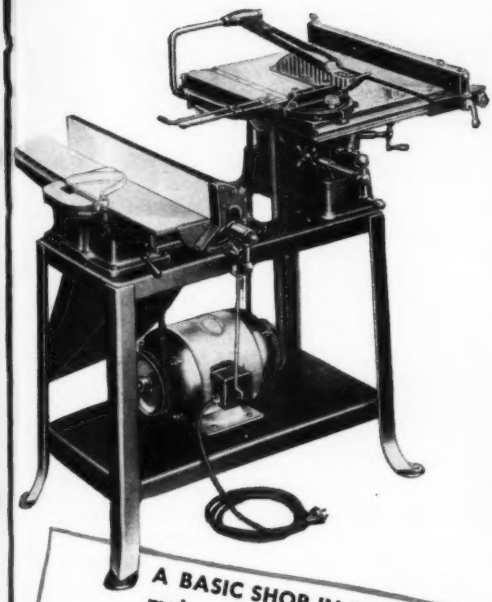
Table-Top Flying Is Hazardous

It is hazardous, this table-top flying—"the most hazardous noncombat flying there is," a CAP pilot described it. And it is over some of America's most formidable terrain, through air so turbulent that it has been known to bounce all the gasoline out of a ship's carburetor and stall the engine.

CAP members get no pay for their aerial trouble shooting. The Government picks up the tab for gas and oil used in search-and-rescue and that's all. The pilot himself pays for wear and tear on his plane.

Arizona's CAP wing is typical of the 52 units functioning in every part of the Union. Arizona has 19 squadrons and a varied membership that includes a 90-year-

[*Continued on page 244*]



You can do 80% of your Woodworking Jobs WITH THIS DELTA Saw-Jointer UNIT

A BASIC SHOP IN ITSELF—rips, miters, cross-cuts, angle rips . . . makes double miters, cut offs . . . joints, planes . . . with accessories, it makes dado grooves, shapes, tenons, rabbets, etc.

Here's the greatest time-effort-space saver you ever saw! It performs most of your woodworking operations, without converting. That means each operation can be performed *in sequence,* without changing over your machine between steps.

For example:

1. Set the circular saw to within 1/16" of dimension and make your cut.
2. Set the jointer for 1/16", run the piece through—and there you are, with a perfect, true, square edge.

These two basic tools are run by the same motor. You can operate both at the same time, or either one individually. Each tool is of correct working height and there's no interference.

This efficient combination tool is a favorite with experienced home-crafters. It has the dependable, built-in precision quality that has established Delta's fine reputation in Industry and among home-shop enthusiasts.

See this great tool at your Delta dealer. Also send for the valuable free book "How to Start Your Home Workshop"—packed with pictures, good ideas, practical suggestions. *Use the coupon.*

SEE HOW DELTA ACCESSORIES ENABLE YOU TO DO COUNTLESS *EXTRA* THINGS

With the Delta Moulding Cutter Head and a set of cutter knives you can cut almost any conceivable moulding shape. You can add more knives as you want them. Other versatile accessories include tenoner and a dado head.

DELTA POWER TOOLS

Another ROCKWELL Product

MACHINES • 246 MODELS • MORE THAN 1300 ACCESSORIES

DELTA MILWAUKEE *Wood and Metal Working Power Tools* FOR HOME AND INDUSTRY

DELTA POWER TOOL DIVISION
Rockwell MANUFACTURING COMPANY
805 A E. VIENNA AVE. • MILWAUKEE 1, WIS.

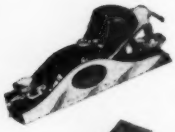
☐ Send me free "How to Start Your Home Workshop"
☐ Send me the name of the nearest Delta dealer

Name_____

Address_____

City_____ Zone____ State____

For cross-grain planing and light with-the-grain cuts — Millers Falls No. 16 Block Plane



For finishing large surfaces — Millers Falls No. 9 Smooth Plane

For truing edges and general all-round use—Millers Falls No. 14 Jack Plane

Three Great Planes

There's a feel and balance and fast-cutting accuracy in Millers Falls planes that has made them favorites for generations with men who use and prize fine tools. So, when you buy a plane — ask for a Millers Falls. Sizes and types for every purpose — smooth-cutting, long-lived tools you will be proud to own.

Millers Falls Company, Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868 ®

The Mark of Superiority

Trouble Is Their Pastime

[*Continued from page 242*]

old desert prospector and a legless veteran.

Biggest of all the Arizona CAP's mercy missions was its part in the great western haylift of 1949. While the Air Force and the Navy went to the rescue of the cattlemen, the CAP's special job was probing far up into lonely, distant canyons to find isolated hogans and drop supplies to the starving Indians. They did their work low over icy wastelands where engine failure would have meant certain death.

Indians Get Choosy

The haylift lasted for many days. CAPers knew the worst was over when the Indians started getting choosy, spelling out "CANDY," "GUM" and "FOLGER'S COFFEE" in the snow.

Nothing gets the goat of a CAPer quite like the accusation that he is buzzing.

"Heck," says Mike Morris, former commander of the Arizona wing, "buzzing is the only way we get the job done."

Some time ago, when a CAP man discovered the wreckage of a missing bomber at the bottom of a deep canyon, an Air Force colonel decided he wanted to have a look at the wreckage himself. So he and the CAP pilot flew to the crash site in a big transport.

Colonel Told Off

Meanwhile, another CAP searcher had spied the debris and gone down for a closer look. He was meandering around the bottom of the canyon in his flivver ship when the colonel's plane arrived high overhead.

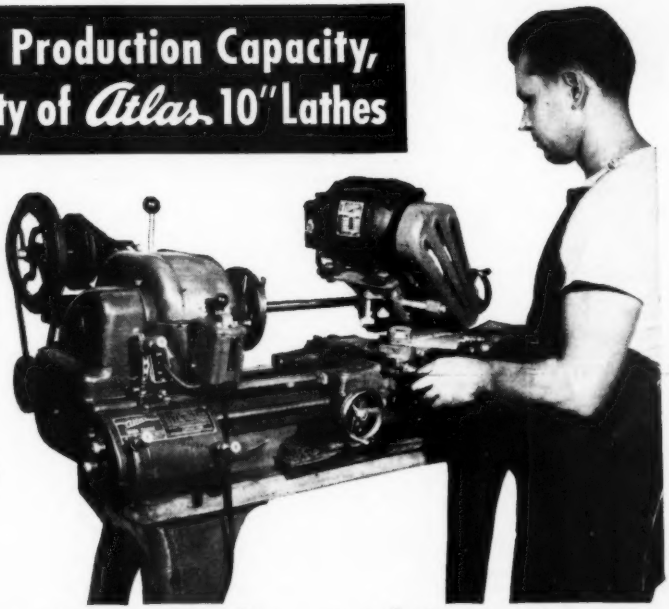
"Who's that dumbbell down there?" the colonel demanded. "He'd better get out or we'll be picking up his pieces, too!"

The colonel's companion shot him a look of polite scorn. "Colonel," he said quietly, "how d'ya think we find your lost airplanes —from way up here?" END

Science Aids the Hot Tamale

For the past several centuries, the housewives of Mexico have ground wet corn to make flour for tortillas, tamales, and other south-of-the-border favorites. But the dough spoiled quickly, and much of it went to waste. Now the Armour Research Foundation, in cooperation with Mexican authorities, has perfected a process for large-scale production of dried tortilla powder.

Get the Extra Production Capacity, Extra Versatility of *Atlas* 10" Lathes

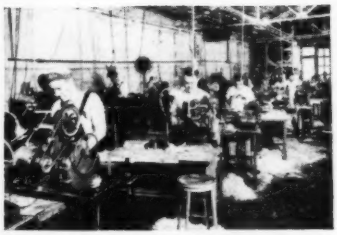


"QUICK-CHANGE"

10" LATHE

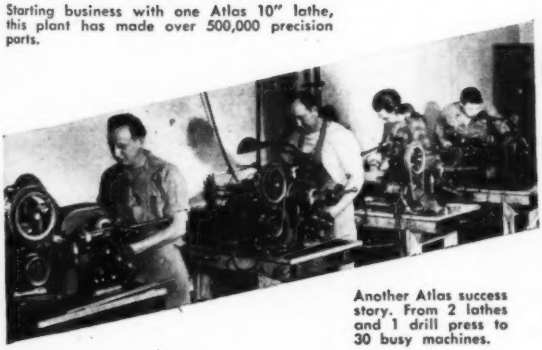
- ★ Timken Tapered Roller Bearings!
- ★ Precision Ground Bed!
- ★ Reversible Automatic Power Cross and Longitudinal Feeds!
- ★ 16 Spindle Speeds — 28 to 2072 RPM!
- ★ Quick-Change Selection of 54 Threads and Feeds!
- ★ V-Belt Drive!

Handle Precision Tooling and Precision Production Runs at Lower Cost



Starting business with one Atlas 10" lathe, this plant has made over 500,000 precision parts.

The many standard construction and performance features you get *without extra cost* make the Atlas 10" lathe the most exceptional value on the market today. For tool room, production, maintenance, service, development work in your plant or home shop — be sure to see how the Atlas can handle your requirements with greater accuracy and efficiency — *at lower cost.* Ask your Atlas dealer or send coupon for latest catalog.



Another Atlas success story. From 2 lathes and 1 drill press to 30 busy machines.

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Please send your latest 10" Lathe catalog.

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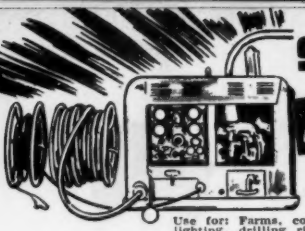
SAVE OVER 50% BUY from C&H



ON THESE BRAND NEW WAR SURPLUS POWER UNITS

BE PREPARED for any emergency!

Use for: Farms, cottages, stores, garages, floodlighting, drilling rigs, refineries, house trailers, fire departments, sound trucks, yachts, tugs, construction, airports, police radios, etc.

LIGHT PLANT BUYERS in emergency telephone collect—unit shipped same day!

300 WATT 110-220 v. AC. 60 cycle light plant powered by 1 HP gas engine, direct drive, mounted base, wgt. 40 lbs. Ideal for campers, P.A. systems, house trailers, etc. Equipped with handle for easy carrying **$99.00**

750-1000 WATT, 110 v. AC. 60 cycle, direct drive, air cooled, Briggs & Stratton gas engine. Model AP. Pioneer generator, radio filter, self-excitor, rope start. 190 lbs. 20" long, 17" wide, 16½" deep with carrying handle. New..... **$169.00**

1000-2000 WATT 110 v. AC **$194.00**

2000-2500 WATT 110 v. AC. 60 cycle, slow speed generator, 5.10 HP Briggs & Stratton gas engine. **NEW** **$294.50**

To make plant 110-220 add **$40** for transformer.

2500-3000 WATT 110 v. AC. 60 cycle, Leland generator, runs at slow speed (1800 rpm) for longer life. 8.25 HP Briggs & Stratton gas engine. You can rely on this plant for all average home needs—freezer, stoker, pump, hot plate, radio, etc., and overloads from starting motors. Reconditioned and fully guaranteed.. **$295.00—NEW $345.00.** Plants, same as above, built in 1951, with tools and spare parts. Lists at $790.00. Our price **$426.00**

To make plant 110-220 add **$40** for transformer.

3000 WATT, 110-220 volt with push button starter. Starter battery is automatically charged by plant. Gas engine same as in plant above **$465.00**

CONTRACTOR'S PORTABLE DC 3000 WATT Briggs & Stratton 5-7 HP gas engine with Delco generator and rubber tired wheels. Used..$220. **NEW** ..... **$279.**

5000 WATT 120 v., 60 cycle AC. Hercules 4 cyl. gas engine. Generator mfr'd by Hobart Bros. Unit includes remote control cable, 150' 2-wire #6, and 150' 3-wire #18, exhaust pipe, power cable plug, spare parts, manual, battery, radio and TV filtered. Unit is completely automatic. List price today $1910. Now priced for you at **$875** used. **NEW** ..... **$895.**

To make plant 110-220 add **$72** for transformer.

GENERATORS

300 Watt, RPM 3400, 110 and 220 v., ½" shaft, **$40.00.** 2500-3000 Watt, RPM 1800, 115 v. AC, **$225.** 3000 Watt, RPM 2800, 110 v. DC, Delco ball bearings, 1" shaft. List $343. To you at only **$99.** 5000 Watt, 115 v., RPM 1800, single phase **$259.** 10,000 Watt, 110-220 v., 60 cycle, 1200 RPM, **$350. TRACTOR DRIVEN GENERATOR** 2500 w. 110-220 v. with Floating mount to keep belts tight **$287.** Generator only **$235.**

7500 WATT 110 v. AC, 4 cyl. gas engine. **NEW** **$995.00**

10,000 WATT, 110-220 volt AC, 60 cycle. Remote control. Powered by a Jeep 4 cyl. gas engine. Used but like new **$1495.00**
$1195.00. NEW .....

25,000 WATT, 220 volt AC, 3 phase or 110-220 volt single phase. Used but like new and GUARANTEED **$2495.00**
$1995.00. NEW .....

35,000 WATT, 110-220 volt, Diesel. Rebuilt **$2995.00**

50,000 WATT, Cummins Diesel generator. 240 volt, 3 phase, 60 cycle, AC 1200 RPM. 150 amps. Rating 50% continuous excitor. NEW— GUARANTEED **$5900.00**

HEAVY DUTY RUBBER ELECTRIC CABLE
(Nothing less than 50 ft.)

4-Wire #18	Neoprene standard, per ft.	7c
2 Wire #14	18 ft. with plug	$3.00
2 Wire #14	18 ft. NO plug	$2.60
2 Wire #14	50 to 225 ft., per ft.	17c
2 Wire #12	12 ft. with plug	$3.50
3 Wire #10	50 to 225 ft., per ft.	30c
4 Wire #10	75 ft. length, per ft.	40c
3 Wire #6	150' with connector	$125.
2 Wire #6	150' with connector	$ 90.
2 Wire #4	75' reel and connectors	$ 80.
2 Wire #4	Concentric 50 to 250 ft. underground, per ft.	60c
1 Wire #1.0	Rubber 30-300', per ft.	54c
15 Cond. #18	G.E. Stranded 30-300' O.D. 13/16", per ft.	50c
10 Cond. #18	Solid, per ft.	10c
Telephone Wire	250', per ft. 2c; 1000'	1½c

SPRAY BOOTH FAN
18 inch

Handles all spray booth and air exhausting jobs with absolute safety in atmospheres containing dust. Totally enclosed 1 HP Motor, 220/440, 3 phase, 3400 RPM. Sealed lifetime bearing. Reconditioned... **$109.00**

HOT ROD SUPERCHARGER

Extra soup and go at a price you can't afford to miss. SEE HOW SIMILAR SUPERCHARGER is used in PICTURE and article p. 67 AUG '50 POPULAR MECHANICS. Mfr'd by Borg-Warner. Specifications: 7½" deep, 7" high. Wgt. 17 lbs. Compact and sturdy. 4 base mounting bolts, ⅜" outlet, ⅜" shaft with female Lovejoy coupling. Priced today at $85.00. OUR SPECIAL SALE PRICE .. **$31.00**

BRASS HAND PUMP

Mfr'd by Red Jacket. Pumps 300 gal. in 30 strokes. Ideal for boat bilge, basements, cattle troughs or other water transfer. 1½" inlet, 1½" or 2" discharge. 78 lbs. $48. value. Only..... **$24.**

COLD WEATHER

HEAT CONTROL

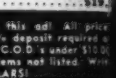
Made by Minneapolis-Honeywell, a name known for the best in controls. 1000 watts—115 to 200 [illegible] Element length 10 ft. Range 70° to 212° F. Controls fans, motors, furnaces. Makes an ideal automatic combination when hooked up to [illegible] heat boosters at right. List price $16.00. Your price ..... **$6.[illegible]**

Prevent Frozen Water Pipes

WRAP-AROUND HEATING CABLE

Electric. Prevents frozen water pipes at temperatures as low as 35° below zero.
26 ft. 60 w. ..... **$4.[illegible]**
56 ft. 140 w. ..... **$[illegible]**
112 ft. 280 w. ..... **7.[illegible]**
Thermostat for above set at 35° F. .. **$[illegible]**

"JANITROL" AIRCRAFT HEATERS



Warms up fast—just the thing for heating trucks, buses, garages, etc. Has an output of 50,000 BTU's per hour. 24 v. DC. Length 23", diameter 12". wgt. 14 lbs. Original cost $130. Special NEW ..... **$19.[illegible]**

ORDER DIRECT from this ad! All prices F.O.B. Milwaukee. 25% deposit required on all C.O.D. orders. No C.O.D.'s under $10.00. Many other bargain items not listed. Write for our FREE CIRCULARS!

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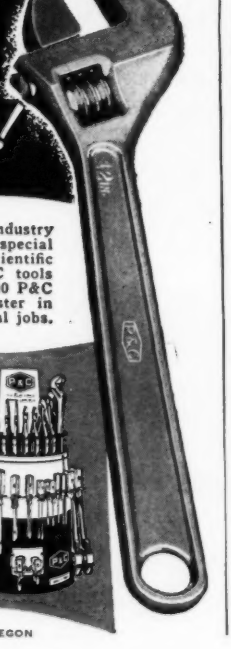
Stay on the job *Longer!*



Really tough jobs—in industry or at home—prove that special analysis alloy steel and scientific heat treating make P&C tools last longer. More than 300 P&C tools are easier and faster in everyday use or on special jobs. Ask your hardware dealer for the P&C tools you need; he will recommend them.

Write for the new folder on P&C tools—"the BEST tools money can buy."

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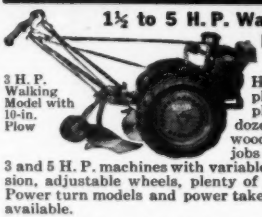
DO IT EASIER—FASTER—BETTER with a SHAW "DU-ALL" WALKING OR RIDING TRACTOR

1½ to 5 H. P. Walking Models Do Everything In Gardening

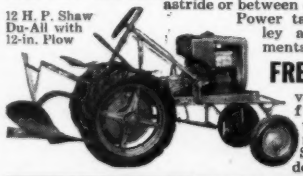


3 H. P. Walking Model with 10-in. Plow

Handle 6, 7, 10-inch plows... cultivate, plant, mow, bulldoze, cut trees, saw wood, do many other jobs fast and easy. 1½, 3 and 5 H. P. machines with variable speed transmission, adjustable wheels, plenty of plant clearance. Power turn models and power take-off attachments available.

Powerful 5 to 12 H. P. Riding Tractors Handle Work on Good Sized Farm

Also ideal for second tractor on large acreage. 5, 8, 12 H. P. models plow 4 to 8 acres daily, plant, cultivate, mow and rake, do many other jobs. Works astride or between 42-in. rows. Power take-off pulley and attachments available.



12 H. P. Shaw Du-All with 12-in. Plow

FREE catalogs and best values you'll find anywhere, by return mail. See a Shaw dealer. Write

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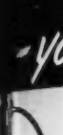
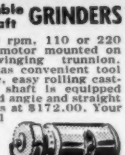
ALL ITEMS GUARANTEED AS REPRESENTED *with confidence from C&H*

"Mall" Portable Flexible Shaft GRINDERS



½ HP, 3450 rpm, 110 or 220 v. dustproof motor mounted on universal swinging trunnion. Heavy base has convenient tool tray and large, easy rolling casters. Flexible shaft is equipped with full speed angle and straight spindles. Lists at $172.00. Your price with all attachments

$109.00



TOOL POST GRINDER 1/8 HP AC-DC, 7000 rpm w/ 3½"x3/8" exter- grinding wheel, smaller nal wheel, 7 ft. rubber switch and attach- es. Lists at $90.00 ..... **$49.50**

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Motor driven (not a vibrator. Heavy duty, adjustable for high, medium or low tone, 110 volt AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, air raid sirens, etc. Lists at $47.00. **NEW.** Your price **$15.45**

Build YOUR OWN DUMB-WAITER Elevator

Get all the convenience of a dumb waiter elevator in store, restaurant, shop or home at lowest cost. We furnish complete parts for elevators similar to those described in ARTICLE on p.p. 174-177 Dec. '51 issue of POPULAR MECHANICS. Steel Car—Guide Rails—Worm Gear—Limit Switches—Electrical Controls—Steel Cable. SEND 25c for completely diagrammed instructions with list of parts, kits and prices.

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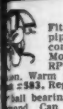
For motor scooters, motor bikes, lawn mowers, etc. Centrifugal action enables electric motors or small gas engines to handle heavy starting loads. 3" A belt pulley. **NEW.** ⅜" bore..**$9.95.** ¾" bore..**$10.95.** 1" bore..**$11.95.**

HEATING SPECIALS

BOOSTER FANS



Fits any 8", 9", 10" furnace pipe. 1500 RPM motor with 6' cord, mounting frame, 7" blade. Motor 110 volt 60 cycle. 1550 RPM. Easy to install. Silent operation. Warm those rooms with long runs. Lists ±$83. Regular $11.95. Your price **$6.95**

Ball bearing fan Mfg. by Emerson. Can be run vertical or horizontally. 110 volt 60 cycle motor with plug on cord. New in original box. Use it for the kitchen as an exhaust fan, heat booster. High pitch blade. 1/25 HP, 1550 RPM only **$11.95**

High Volume BLOWERS

Top performance for forced draft, ventilating, exhausting, cooling and drying. 110 volts AC. Intake 9", discharge 2½", 75 cubic ft. per min...**$10.95** Intake 5", discharge 3", 150 cubic ft. per min.....**$13.95**

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Westinghouse or Chromalox immersion heat- ing unit, 110 v. AC adjustable from 312-626- watts and automatic cut valve. Valued $42.50. Only $5.95. Combination price heat control above.....**$9.95**

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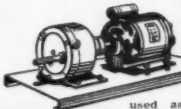


Double reduction. Operates on any 1/6 to ½ HP electric motor. 32 RPM. Can be used as winch, operate turntable, electric garage door opener, television antenna, Barbecue, dummy elevator. Regular $43.00. Now Only **$22.00**

54 TO 1 BOSTON SPEED REDUCER

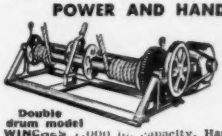
Reduces speed of ordinary 1750 rpm electric motor to 33 rpm. Lists at $55.00. Our sale price **$29.50**

AIR COMPRESSORS

Gas or electric. Awarded from government.

½ HP	12 gal. tank		$ 99.00
1 HP	30 gal. tank		239.00
1½ HP	30 gal. tank		265.00
2 HP	50 gal. tank		295.00
3 HP	60 gal. tank		410.00
5 HP	60 gal. tank		485.00
7½ HP	80 gal. tank		675.00
10 HP	80 gal. tank		775.00

POWER AND HAND WINCHES



FOR BOATS, TRUCKS, CONTRACTORS, FARMERS, LOGGERS, ETC.

Double drum model

WINCHES 1,000 lb. capacity. Hand operated..$ 9.95
WINCHES Hand operated ball bearing model, 1500 lb. capacity, 3-1 ratio, hand brake, two speeds ..... $ 39.50
WINCHES 6,000 lb., double drum. Hand operated ..... $ 49.50
WINCHES 1,500 lb. electric drive..... $ 89.50
WINCHES 6,000 lb. electric drive..... $188.50
WINCHES Single drum. 3½ HP motor 110 or 220 AC. Start, stop and reversing switch, belt, pulleys. 100' 3/16" steel cable. 2000 lb. pull. Ratio 12 to 1. NEW $125.00. Double drum model..... $135.00
CABLE ¼" preformed stainless steel aircraft. 100 ft. or less....17c per ft. Over 100 ft.....15c per ft.

and other bargain items

GOODRICH RUBBER HOSE 2" I.D. 2 ply, 25' lengths. Value $25. Only..$3.95, or 3 lengths for....$10.00
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OHMMETERS Read 25 to 0. In leather carrying case. Regularly $29.95. Only..... $7.95
FYR FYTERS Fire extinguisher approved by Underwriter's. Regularly $14.95. Only..... $6.95
½ TON SHOP UTILITY WAGONS, steel frame, rubber tires, ball bearings..... $48.50
WELDING ROD Manufactured by Murex. All purpose type S. AC-DC, 5/32", 50 lb. box..... $3.00

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Remove the guide, fill the hole with a putty-like mixture of Smooth-On No. 1 Iron Cement and drive the guide back in. It will stay in place, because Smooth-On, in hardening, expands slightly and takes hold tight. Use Smooth-On for tightening other loose parts and also for stopping leaks in boilers, furnaces, piping, radiators, etc. Buy Smooth-On No. 1 in 1¼ oz., 7 oz. and 1 lb. or larger sizes at your hardware store. If they haven't it, write us.

FREE Repair Handbook

Shows how to save time and money, making many household repairs. 40 pages. 170 pictures. Clear directions. Send today.

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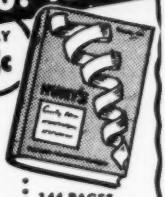
THE IRON REPAIR CEMENT OF MANY USES

Send for this BIG NEW Hunt's WOODWORKERS CATALOG NO. 18

ONLY 15¢



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For Fast Starts; Driving Protection

Be *sure* of quick, easy starting this winter! BOWES Combustion Aid absorbs the water in your fuel lines, keeps them free of gums, softens and removes carbon. Easy to use . . . just put it in your gas tank . . . and have dependable, inexpensive cold weather protection! Your Bowes "Seal Fast" dealer can supply you.

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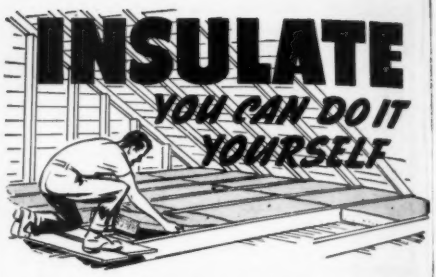
It will pay you to visit your nearest Bowes dealer for tire and tube repairs . . . fan belts . . . oil filter cartridges . . . battery cables with terminals that *can't corrode* . . . and other fine automotive services and accessories "for smoother motoring."

DRIVE IN WHERE YOU SEE THIS BOWES EMBLEM

BOWES "SEAL FAST" CORP., INDIANAPOLIS



IT'S a cinch to insulate your home with Gold Bond Rock Wool Batts or Blankets. You'll save a lot of money in fuel bills and keep your house warmer in winter, cooler in summer. Light, easy-to-handle batts slide between rafters or attic floor joists. You get extra fire protection too. Gold Bond Rock Wool Batts and Blankets *can't burn.* Batts are 2 and 4 ft. long, Blankets 8 ft. long. Both come in standard widths to exactly fill the space between framing members. Be sure they're "full-thick" and bear the Gold Bond name for maximum insulation and fire protection.

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POWERFUL! PERSONAL! PORTABLE!

- Covers Full Broadcast Band 550-1600 K.C.
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- No Antenna Used for Local Reception
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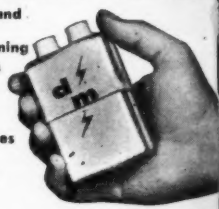

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This neatly engineered little set was designed to give you a real personal, portable radio that you can enjoy anywhere without disturbing others. Use it at the ball games, camping trips, in bed, in your office or just anywhere. Remember this is not a weak crystal set but a powerful tube receiver that will give you good local and long distance reception. Complete set, less batteries, ONLY $5.99 postpaid. On C.O.D. orders please remit deposit of $1.00. If batteries are desired we will supply at only $1.50 per set or you may obtain from your local hearing-aid concern.

Order Today at this Unbelievable Low Price!

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Extra long life, rechargeable, ideal for portable radios, mobile units, etc. 2 V. 20 Amps. Only 5" high ball float hydrometer, built-in Lucite case. Shipped dry. Used singly or in multiples. Shipping wt. 3½ lbs. Govt. cost approx. $8—NEW—$1.95.

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It pays its way in just 1 day! It's sensational! New HAND MITRE saves 100's of hours, requires only a "flick" of the hand for a precision mitre every time. HAND MITRE will cut any desired angle. Its rugged construction handles hard and soft wood mouldings, plastic trim, base shoe, laminated materials, rubber extrusions, etc. Made of heavy gauge stainless steel. **$3.95** postpaid.

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ULTRA PRECISION—0-6" in .001 graduations. Quick, accurate depth, inside, outside measurements, fine engraving. Extra heavy rule, hand-fitted sliding head, no side play. Rockwell C.60, lapped measuring surfaces. For the extra particular mechanic who must have the best—used and recommended by most critical experimental and research machinists at Lockheed, Douglas, Bendix, GM, RCA, General Electric. Save 50%! A $37.50 value—only **$14.75**, leather case incl. Also a standard grade Mauser Design Caliper made in Germany. For the production machinist, 0-6" in thousandths, the most accurate caliper of this type on the market, 1000's of satisfied users. Only **$10.95**, leather case incl. These Calipers are of acceptable quality for precision aircraft work. Both are guaranteed buys, money back if not entirely saftisfied. Order now!

New low price due to lower import duty!

MAGNETIC BASE INDICATOR HOLDER

For all types of dial indicators with guaranteed lifetime ALNICO magnets. V-slotted base has a 45 to 50 lbs. pull, permits immediate application without clamps or special attachments and mountings can be made on cylindrical surfaces. For machinists, tool-makers and inspectors. Base 3½" long by 1⅛" wide. NEW. **$3.50** ea.

HIGH SPEED DRILLS

All new. Fractional & numbered. Orig. value $18. Nationally known brand. Assorted sizes. Set of 30, **$3.50**

WOODWORKERS DRILLS

From 5/16" to 1½" with ¼" shanks. A $12.50 value — NEW — just **$2.50** for complete set!

HIGH SPEED STRAIGHT SHANK DRILLS

10 different size H.S. Straight Shank Jobber Length Drills, ¼" to ½" (shank same diameter as drill). $25 value. NEW—**$3.50.**

HIGH SPEED DRILLS

SET from 1/16" to 33/64", 5 sizes with ¼" Shanks—NEW—get this, **$3.00** takes this set!

LOW VOLTAGE CIRCUIT TESTER

Made for U. S. Ordnance Dept. to rigid specifications. Portable steel hand carrying unit is a self-contained trouble shooting device for making a complete and rapid check of the generator battery circuit, including any circuit and voltage regulators. Battery voltage, regulators, cut-out settings and generator performance can be easily determined. A terrific testing unit for garages, mechanics, truck fleet owners, boat and marine mechanics. Can be used on any 6 or 12 volt system. Govt. cost approx. $175. NEW—complete with instruction book—only **$32.50.** Shipping weight, 20 lbs.

POCKET-PACK PRECISION WRENCHES

Made of first quality chrome—molybdenum steel, heat treated and hardened for extra strength. Each wrench accurately broached to close tolerances. Open end wrench on one end and twelve point box on the other means double usefulness and double value. NEW, complete with plastic case—**$1.75** ea. complete—postpaid in U.S.A.

SOCKET-PACK WRENCH SET

Chrome-plated alloy steel, heat treated, broached to close tolerances. Reversible ratchet handle, with screwdriver bit on reverse side. Built-in spring-loaded ball retainer on both handle and extension. Clear top plastic kit. 10 piece set—NEW—complete **$3.75.** POSTPAID in U.S.A.

FLEXIBLE SHAFT MAGNET

Strong ALNICO V Magnet on 18" flexible, Cadmium Plated shaft. For picking up cotter pins, nuts, wrenches, etc. from inaccessible places. Removes Bobbie Pins etc. from drains. Lifetime Magnetism Guarantee. Highly polished magnet and handle. **$2.00** postpaid

RIVET SETS

Universal type, case hardened tips. Set of dies will head up any brazier or round head rivet from 1/16" to ⅛". With adapters for air gun or hand use. All new—cost Govt. approx. $27.00. Complete 15 piece set (wt. 2 lbs.) **$5.00.**

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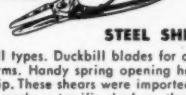

Blades inlaid Wolfram Vanadium, guaranteed to hold edge under constant severe use on heavy gauge metals of all types. Duckbill blades for cutting straight, circular or irregular forms. Handy spring opening handles for better leverage. Full hand grip. These shears were imported from Germany and only because we made a terrific deal on them can they be priced—NEW—10" size, **$2.45** ea. 12" size, **$2.95** ea.

DRILL GRINDER

Sharpens round, square or tapered drills up to 6" long. Even an amateur mechanic can get a new, factory finish on a drill in 25 seconds. New protractor feature gives every drill sharpening angle, with 5 convenient angles already marked off. Usable with hand or power stone. A brand new development. All New. **$2.80** ea. Postpaid in U.S.A.

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Chrome plated, precision engineered, carefully tooled give long life. All new 0-1" capacity—**$2.25** ea. 1-2" capacity—**$3.50.**

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SO EASY: With this new filing jig and jointer anyone can now sharpen any handsaw like new! When file hits hardened steel rollers teeth are finished and EXACTLY SAME HEIGHT. All teeth cut and saw runs true and smooth. Jig and Instructions **$2.95** postpaid. Free literature.

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The RIGHT WAY on your own saw table. Sharpens rip, cutoff, hollow ground and combination blades —8" to 10". Saws stay round with correct bevel. Precision made, easy to use. GUARANTEED. Only **$8.95.** Includes $3.00 Grinding wheel. "TRU-CIRCLE" saw set automatically sets teeth at 10° or more **$2.95**

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Removing paint?

You'll be glad you tried WONDER-PASTE—the time-tested paint remover used by professional painters. Just apply it over any paint, enamel, varnish or lacquer and let it penetrate. Then see how *easily* you can strip off the old finish! No hard scraping or sanding. It *can't run* on upright surfaces. At leading paint and hardware stores.

Write for leaflet

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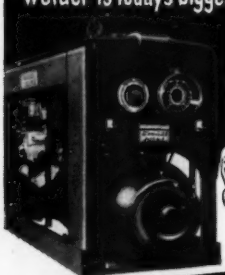
Wilson-Imperial Company, 121 Chestnut St., Newark 5, N. J.

HOBART Arc Welding PAYS BIG!

If you have this versatile, all around HOBART arc welder, you're equipped to start your own welding business—to cash in on the demand for dependable arc welding.

Costs LESS than you think! This big 250 amp. gas drive welder is today's biggest value



Hobart is made in gas and electric drive models—port. or stationary.

Welds anywhere...plus power *for lights and tools*

You learn RAPIDLY at the HOBART TRADE SCHOOL

Prepare now to step into a big pay defense job or to start your own profitable welding business. Learn to do all kinds of welding quickly, easily, at low cost in America's most modern welding school . . . the non-profit Hobart Trade School. Complete or partial courses. Best equipment, experienced instructors, thorough training. *Check coupon for full details*

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Hobart Welders are used in leading production plants everywhere—give you 1,000 combinations of heat, let you make fine adjustments at the job—no returning to machine.

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"One of the world's largest builders of arc welders"

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Free New booklet "Guide to Better Welding"

Please send complete information and literature on items checked.

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SAVE $50 OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

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- Capacity and performance of commercial saws selling for $60 and up

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- 27x28 in. table, 13½ in. capacity in front of blade
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- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) **$20.95**
Same Kit with 10" Combination Blade **$24.90**
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GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires
- Uses standard 78 inch blades up to ¾ in. wide
- Fully enclosed mechanism for utmost safety

GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ¼ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and all other metal parts **$20.95**

Return Kits in 10 days for refund if not satisfied.
(Prices include postage within 300 miles. Over 300 add 5%)

Also available—Plans and Parts Kit for Belt Sander and 8" Tilt/Table Saw. Order Plans at $1.00 each—Send postpaid anywhere in the world or write for FREE descriptive catalog.

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2 to 6HP walking and riding models with complete gear drive and reverse. Also new 1-wheel "Bantam." Low prices — easy terms.

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MODERN LAWN MOWER SHARPENER

FOR LAWN MOWER SHOPS FIX-IT SHOPS GOLF COURSES • PARKS 101 OTHER JOBS

PRICE $241.00 less motor

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Sharpens All Reel Type Mowers • Hand, Power or Gang • 10 to 20 Minutes • No Dismantling • No Extra Attachments Needed.

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets. Grinding head rides on five ball bearing races. Easy to operate. Also sharpens chisels, joiner knives, planer blades. Big profit maker. Own your own business. Send Today for **FREE Illustrated Bulletin No. 11-C1.** Prices Subject to Change Without Notice.

ORDER NOW Immediate Delivery

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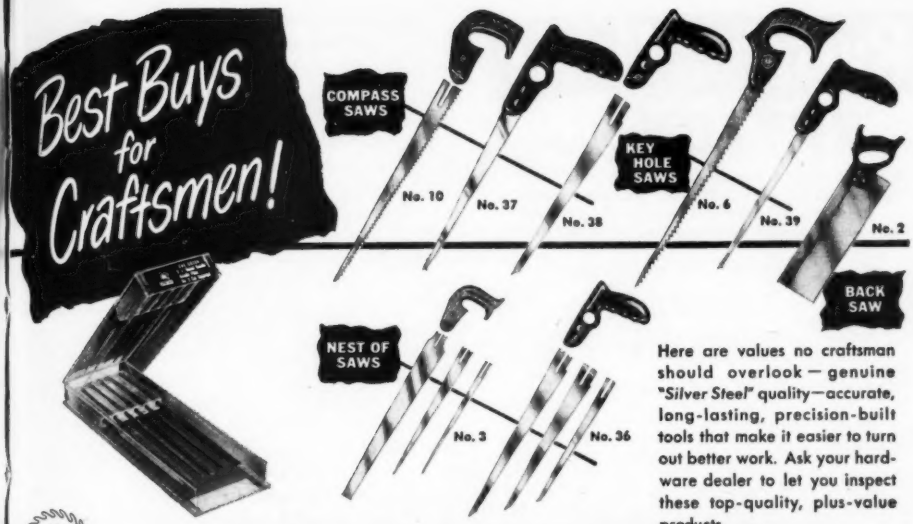

Here are values no craftsman should overlook — genuine *"Silver Steel"* quality—accurate, long-lasting, precision-built tools that make it easier to turn out better work. Ask your hardware dealer to let you inspect these top-quality, plus-value products.

ATKINS "ATKINS ALWAYS AHEAD"

ATKINS

Use—Don't Abuse—Fine Tools!

E. C. ATKINS AND COMPANY • 402 S. Illinois St., Indianapolis 9, Indiana

Why does your engine wear out faster in winter?

Ask your mechanic—and he'll say it's because it takes time (up to five minutes) for oil to reach engine parts after starting. And in winter, cold oil is sluggish, moves slowly. So friction works longer . . . causes "Engine Ulcers" as dry metal grinds against dry metal.

But not when you use Miracle Power in your gas and oil! The colloidal synthetic graphite in Miracle Power clings to surfaces . . . lubricates until oil gets there. Reduced friction means your engine *starts easier, runs with less effort, uses less gas.* Try Miracle Power next time you get gas.

THE AP PARTS CORPORATION *Miracle Power Division*
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At better service stations, garages and car dealers, or use this coupon for your introductory offer.

THE AP PARTS CORPORATION
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Enclosed find $_____ for which please send me *postpaid:*

_____ trial cans of Miracle Power at 75c each (1 for gas, 1 for oil)

☐ Please send me free literature on making my car last longer.

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Rustproof Metal!

"KRYLON-*ize*"

home and garden tools—fishing rods and other sports equipment—nailheads and screwheads — children's playground equipment — lawn furniture—screens—hundreds of other objects!

If you prize it— "KRYLON-*ize*" it!

Krylon is a miracle of modern chemistry—a crystal-clear ACRYLIC coating that seals out water, air, moisture, dirt. Just press the button on the aerosol can and spray Krylon on. That's all there is to it! Krylon won't change color, crack or dry out. Waterproof, non-flammable. There's absolutely nothing like Krylon. It's America's *Acrylic* spray. Spray Krylon on almost any paper, leather, wood or metal surface. Protects, preserves, beautifies. "KRYLON-IZE" leather bags and luggage, valuable papers, photographs, washable walls, etc., etc. Hundreds of uses in every home! At hardware and paint counters everywhere in the big 12 oz. aerosol spray can.

KRYLON is also available in ALUMINUM and BRIGHT WHITE
All the qualities of clear Krylon, plus brilliant color. Go farther, last longer, clean easier, easier to apply than paint or enamel. Big 12 oz. aerosol spray cans.

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"YANKEE" VISES

hold work through every step without a misstep

Write for "Yankee" Tool Book

Any job locked in a "Yankee" Vise is correctly positioned for every operation . . . hand or machine. Lifts on and off swivel base at bench. Machined accurately . . . top, bottom, sides and front end . . . V-grooved block for rounds. Four sizes, with and without swivel base . . . 1½", 2", 2¾" and 4" jaw widths. At your dealer's.

YANKEE TOOLS NOW A PART OF STANLEY

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THE TOOL BOX OF THE WORLD

Scientist Invents Color-TV Tube

[*Continued from page 147*]

—Chromatic Laboratories, Inc., a subsidiary of Paramount Pictures Corp. Since last October, Chromatic has maintained a laboratory in Oakland. As "consultant," Dr. Lawrence makes suggestions and keeps an eye on things. But nuclear physics remains his main interest and he shows up only at odd hours. In fact, he is a bit distressed by the fuss his tube has stirred up. Friends say he does *not* want to be known as "the television man who also invented the cyclotron."

Chromatic is ready to begin producing the tube at a plant in Connecticut. Although details may change under production conditions, the grid will probably contain about 400 parallel wires. The screen will be silk-screen-printed with parallel lines of phosphors a few hundredths of an inch wide. A backing of vaporized aluminum will act as a mirror to increase brightness, and will be charged to attract the electrons. Instead of coming from the gun at the usual 12,000 volts, electrons in the Lawrence tube will start at 4,000 volts and the additional voltage will be added at the viewing end. END

Bonuses Spur Uranium Output

During 1951 the United States advanced to second place among the world's free nations in production of uranium, and now ranks next to the Belgian Congo, the Atomic Energy Commission reveals.

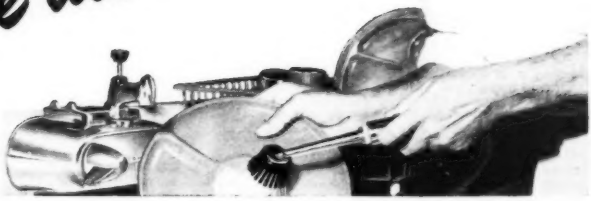
Ranging up to $35,000, new Atomic Energy Commission bonuses are helping to spur domestic production of the vital raw material for A-bombs and atomic power. These are in addition to a previous $10,000 bonus offer, which still stands.

The AEC has offered the $10,000 reward since April, 1948, for "the discovery of a new deposit and the production therefrom of the first 20 short tons of uranium ore or mechanical concentrate assaying 20% or more uranium oxide." This is very high-grade uranium ore—and no one has yet collected the bonus, at this writing.

The new bonuses are within easier reach, and more generous, too. They went into effect last spring and are described in the Atomic Energy Commission's official statement on the subject as "additional incentives for uranium mining."

to the 4 out of 5 men who help with the dishes*

You'll do the job faster, easier and *better* with Dishmaster the push-button dishwasher. Dishmaster's aerated suds dissolve the toughest grease almost on contact. Dishes, glasses, silver—even pots and pans—come clean in a jiffy.



Actor Arthur Lake of "Blondie & Dagwood" fame uses one all the time!

And because you don't do the dishes *all* the time, you'll want your wife to have the benefit of fast, easy, push-button dishwashing too!

Columnist Cedric Adams says—"I have a Dishmaster—wouldn't be without it."

Guaranteed by Good Housekeeping

*A recent survey says you do.

Handsome, chrome-plated Dishmaster fits any sink. Easy to install.

DISHMASTER

The Push-Button Dishwasher

HERE'S THE HEART OF YOUR DISHMASTER
Carburetor-like action gives foaming, aerated suds.

FREE

Send coupon for copy of "Dishwashing The Easy Way." If you want a Dishmaster *right away* and your dealer cannot supply you, send Gerity-Michigan your check for $49.50.

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EXPAND YOUR HOME!

Install the
PRECISION
Folding Stairway
at a cost of
$60 to $75

Equipped with *Roller Bearings*

Makes your home more livable by providing extra rooms and storage space in the most economical way. Fits all ceilings—Just saw a 26x54 inch hole in your ceiling, frame the hole with 2x6's, nail the stairway in place and cut off at the calibrated ceiling height.

SIMPLE AND EASY TO OPERATE—A slight pull of the cord and the counter weights that operate on factory packed roller bearings silently ease the stairway into down position. The same counter weights return the stairway to its up position with equal ease. RUGGED AND STRONG—Construction of No. 1 kiln dried poplar. Brackets, rocker arms and hinges of heavy cast aluminum alloy. All parts numbered and interchangeable. Panel insulated and protected with tough chip board. Steps covered with safety treads. FITS ANY CEILING—from 7 feet to 10 feet 3 inches high. Runners graduated to facilitate cutting off for different ceiling heights. REQUIRES NO ATTIC SPACE—Full height above attic floor only 36". Folds completely into opening in ceiling. SHIPPED IN ONE PACKAGE—Each stairway thoroughly inspected, assembled and ready to install. Shipping weight 130 pounds. Sold by more than 12,000 dealers in U.S.A. and Canada. APPROVED BY F.H.A. EVERYWHERE. Mail coupon TODAY for descriptive folder and complete information concerning delivery, prices and installation.

TO MAKE YOUR HOME MORE LIVABLE,
Mail This Coupon today!

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403 North First Street, Nashville 7, Tenn. PB

Please send me FREE folder and complete information on PRECISION folding stairways.

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America's Finest Power Mowers completely assembled in 3 and 4 wheel models. Belt or direct drive. 18" and 20" sizes. Nationally known make engine. Latest improved features, sturdy construction and money back guarantee fully described in color folder. Write Today.

TRIANGLE MANUFACTURING CO., Box S-9, Fort Scott, Kansas

5,000 MORE MILES From FRONT TIRES

"Educated Nut" Stops "Scuffing"—FREE TRIAL!

Long used by truck fleets (200,000 now in use) the "Educated Nut" is now available for all passenger cars. Allows you *perfect* adjustment on front wheel bearings every time. Replaces front wheel bearing nuts now on your car. When you "back-off" your present front wheel bearing nuts to insert cotter pin, you loosen your bearing adjustment enough to cause as much as ⅜" wobble on the tread. This causes "scuffing" and "snaketracking", costs you speed, rubber, gas, brakelining and $$$$$.

THE EDUCATED NUT

- Adds up to 5,000 miles more tire life
- Stops bearing breakage
- Makes steering easier, safer
- Increases brake efficiency, stops ⅔ of all brake squeaks

HOW TO INSTALL

Screw threaded piece up to perfect adjustment (turn up tight, then back till wheel revolves free). Then line up cotter pin holes in cap with hole in spindle, snap on steel cap, insert cotter pin. You never "back-off" more and destroy adjustment to insert cotter pin as with old style nuts.

FREE TRIAL—Send no money. Just send name and address, make and year of car. A complete set of "Educated Nuts" (2 nuts, 2 caps, 2 pins) and instructions will be sent postpaid. Install and try. Feel the difference in driving immediately! Within two weeks, either return the complete set at no obligation or send just..... **$2.98**

Dealer, truck owner, inquiries invited.

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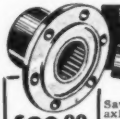

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Ends front wheel drag on 4-wheel drive Willys Station Wagons, Pick-ups and Jeeps

$20.00 Prepaid U. S., Canada

Saves gas up to 5 miles per gallon, tire wear, front axles, increases speed and power. Stops shimmy—front wheels coast out of gear! 4-wheel drive handles, performs, climbs like 2-wheel. Install or remove WARN HUB CAPS in 10 minutes. Polished aluminum, guaranteed. Rush check, M.O., or C.O.D. Write for circular.

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Portable GARAGE

Adds Years to Car Life

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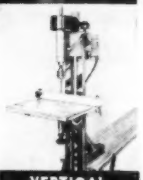

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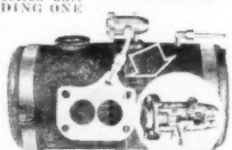

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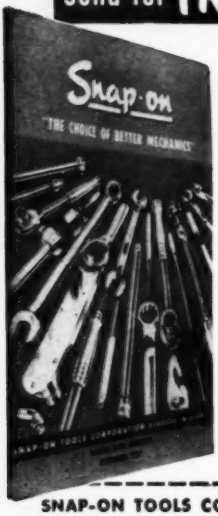

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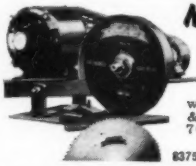

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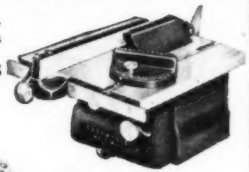

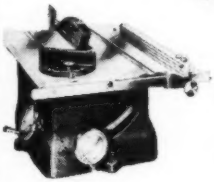

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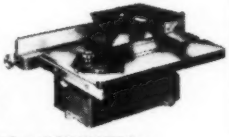

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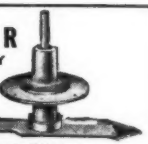

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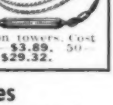

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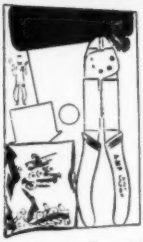

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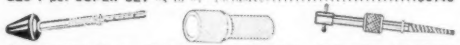

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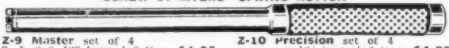

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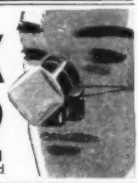

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NEW! No. 445 "ARCO-SAW" for DEPTH & BEVEL CUTS

At Better Hardware Stores Everywhere

11.50 with all GAGES & 4" "HYCARBON" Crosscut Blade.

CAN BE USED WITH ONE HAND! "ARCO-SAW" works like a high priced Portable Saw. RIGHT ANGLE GEAR DRIVE eliminates clumsy, dangerous direct drive with drill sideways.

CUTS 1-1/4" or 2x4 by turning over

Depth gage graduated from 0 to 1¼" depth (for grooves, dados). **Bevel gage** graduated from 0 to 45° angle (for dovetails, bevels), **Rip gage** with sideways adjustment. **Visual guide** with adjustment to follow lines on both straight and bevel cutting. **90-DAY FACTORY GUARANTEE.**

UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE

No. 444 "ARCO-SAW", same as above—less gages. Has accurate visual guide . . . **9.95**

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Extra "HYCARBON" Blades. 4" Crosscut or 4" Combination **1.60**

ARCO SAW

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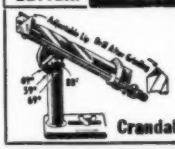

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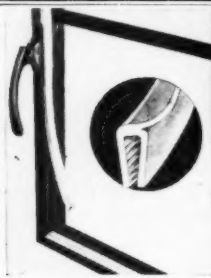

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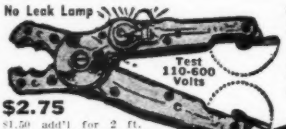

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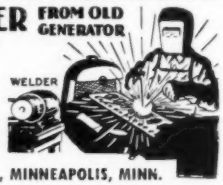

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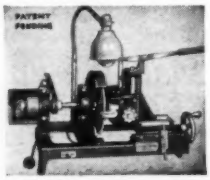

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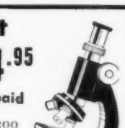

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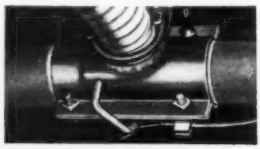

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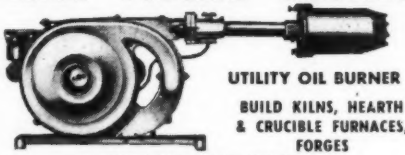

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CUTS 2"x6s" in 2½ SECONDS!

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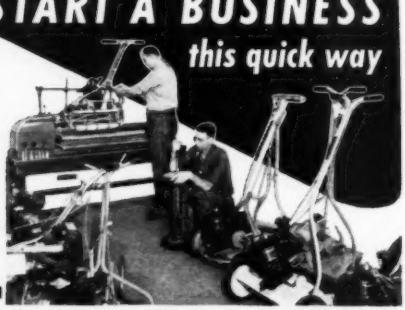

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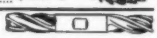

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SET 29W 4 Right hand twist 7/16 shank end mills, size 5/16 to 7/16. Used surplus only **$3.95**

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SET 25W 15 Different Size High Speed Morse Taper Shank Chucking Reamers up to 1/2" with No. 1 and 2 tapers. New and used. Priced at only..... **$6.95**

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8-36 (new)	$.35	5/8-NF	$.66
1/4-NC or NF	.26	3/4-NF	.80
5/16-NC or NF	.29	1-NF	1.25
3/8-NC or NF	.33	1/8 pipe	.35
7/16-NC or NF	.39	3/8 pipe	.50
1/2-NC or NF	.47	1/2 pipe	.90
9/16-NC	.60	3/4 pipe	1.25

NEW SEMI-HIGH SPEED

COMBINATION DRILLS AND COUNTERSINKS

60° Angle of Countersink

SIZE	DRILL SIZE	BODY	EACH
C2	1/16	13/64	$0.49
E1	3/32	3/10	.49
F1	5/32	7/16	.69
F2	3/16	7/16	.69

5% discount for purchase of 1 doz. of any size or mixture of above.

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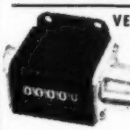

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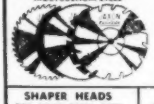

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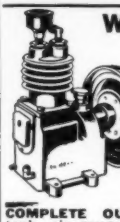
Wellworth AIR COMPRESSOR



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Compressor has 2" bore, 1¾" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: ¼ h.p. at 100 lbs.; ⅓ h.p. at 125 lbs.; ½ h.p. at 150 lbs. or equivalent gas engine. V-belt drive, intake muffler and cleaner, bronze bearings, splash lubrication. Wt. 16 lbs. Replacement parts always available **$20.50**

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Equipment less compressor..... **$12.45**

Tank only, $6.25

Wellworth COMPRESSOR BUY

1 YEAR GUARANTEE

FEATURES

2 compression and one oil ring, aluminum alloy connecting rod. Stainless steel valves with brass seats and retainers. Cool-flo cylinder head, spray mist lubrication to every moving part. 10¼" V groove fly wheel for ⅝" B section belt.

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2½" x 2". 2.55 to 4.80 c.f.m. up to 150 lb. pressure. Operates with ⅓—½—¾—HP Motor. Special Price . **$27.95**

Shipping wt. 24 lbs.

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2 cylinder 2⅛" x 2". 5.10 to 8.50 c.f.m. up to150 lb. pressure. Operates with ½—¾—1—1½ HP motor. Special Price..... **$54.50**

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BRAND NEW. Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛" x 11⅜"; inlet 8⅝", Height 19", Width 18". Depth 16½". C.F.M. ¼" S.P. 1600; outlet vel. 1575. Wt. 45 lbs.

BLOWER LESS MOTOR AND DRIVE..... **$27.50**

With belt and variable speed pulleys, $2.50

Same Blower, complete with ¼ HP Motor... **$47.50**

140 CFM "WELLWORTH" BLOWER

5⅛"x4" mounting flange with 2½" square discharge, 3½" dia. blower wheel powered by direct-connected 1/15 H.P., 110 V. 60 C., A.C. motor with conduit box and 20" leads, 7½" wide less flange by 7¼" H. x 6¾" D. Shpg. wt. 6 lbs. **$16.20**

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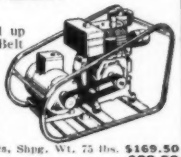
Heavy Duty Windings



110 v., 60 cy., A.C., takes starting overload up to 5000 watts. Floating Base for Automatic Belt Adjusting, 2-Groove Engine Pulleys, V-Belts, Bolts, etc. 5 H.P. Wisconsin or Briggs & Stratton Model 14 Engine. Voltmeter, 2 plug-in receptacles. Portable Tubular Steel Skid Type Carrier. Dim. L 34⅝" x W 17" x H 20". Wt. 180 lbs. **$299.50**

Generator only with voltmeter, 2 plug-in receptacles, Shpg. Wt. 75 lbs. **$169.50**

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5000 to 6000 watts Generator, 110-220 V., wt. 225 lbs. **$325.00**

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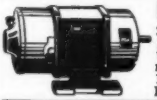

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BRAND NEW Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3½" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**

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Ship. Wt. 12 lbs.

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With ⅛ Inch Adjustable Chuck

Converts any motor, drill press, electric drill, electric fan (10 inch or larger) into a handy rotary tool.

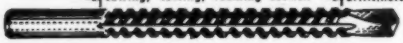
Attach ROTA-SHAFT in a jiffy. Use for grinding, polishing, sharpening, cleaning, engraving, making tools, carving on metal, plastic, wood, leather, glass. **Handles tools from zero to ⅛ inch diameter.** 40-inch overall length. Complete with buff and sanding disc ready to use in a drill press chuck. ORDER TODAY!

SEND NO MONEY! Mail your order. Pay postman only $3.95 plus postage on delivery. Try 10 days—if not delighted return for money back. **For use on motor—35c extra for Special Coupling. Give exact size of motor shaft diameter.**

STRADER PRODUCTS CO., Dept. E-102

259 Strader Ave. Cincinnati 26, Ohio

Make YOUR ELECTRIC DRILL A MULTI PURPOSE TOOL



DRILL, SAW, REAM . . .

. . . metal, pipe, wood, plastic, Transite, etc., with the all-purpose International Rotary Cope-Saw Drill-bit shown above. Use with any electric drill, slow drill press, lathe or milling machine. Drills own starting hole—upper part of bit is used to cut, saw or ream circles, ovals, squares or scrolls. Easy to operate. Ideal for carpenters, mechanics, electricians, plumbers, hobbyists, many others. Abrasive resistant, high speed steel. Flutes ground from solid. Will withstand severe continuous use without breaking. Resharpened at no charge. Takes place of up to $50 in tools. ¼" diameter, 2" cutting sections, total length 3½". Also available bits specially designed for wood or metal and in 2⅜" and 1¾" lengths. Write for details. Specify all-purpose bit.

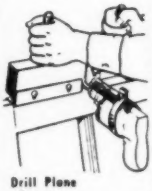
Drill Press

Handy Cutter

Drill Bit $3.95 Post Paid

NOW YOU CAN PLANE . . .

. . . with your ¼" electric drill and the International Drill-Plane-Converter. For fast, accurate planing, beveling, ripping. Rips up to 1¼" strip, planes ¼" at one stroke, 15 times faster than any hand plane. Rips boards up to 1¾" thick. Nothing like it exists. Too many uses to mention. 2 planing blades made of finest available High Speed steel included. Blades are ¼" diameter, 2" cutting surface. Electric Drill not included. Regular electric planers cost up to $150.00.



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Plane Converter $14.95 Completely Assembled

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IT'S EASY TO MAKE $3. AN HOUR AND MORE SHARPENING LAWN MOWERS

IN YOUR SPARE TIME

J. S. of Michigan writes, "I figure my profits for last season at over **$1,000.00 part time.**" C. R. of Ohio tried the Universal on a part-time basis and now gives it full time. He says "I have taken in, last season, **more than $3,500.00.**"

ONLY ON THE UNIVERSAL LAWN MOWER GRINDER

can the inside face and edge of the stationary blade, and all reel blades, be ground to proper clearance

ALL IN ONE SET-UP

WITHOUT REMOVING ANY BLADE FROM THE MOWER

Write for details. Learn how to make real big money.
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SAVE 85% in WAR SURPLUS

FAMOUS GSAP 16MM CAMERA

That famous "gun camera" used by the Navy & USAF. Now adapted to hand use for making professional or amateur movies. Takes pictures in B&W or full Color. Has 1-3/8" lens, built-in exposure guide and shade. Adjustable for 3 SHUTTER SPEEDS – 16,32 & 64 frames per second. Uses regular Eastman magazines (50 ft). Requires no winding – no film threading. Comes complete with 'ZOOM' Range-finder & Battery Box. Operates on 24 volt current supplied ordinary flashlight batteries. READY TO USE! (Needs only film & batteries).

44.95

150 POWER ALL PURPOSE COMBINATION MICROSCOPE

A TRIPLE PURPOSE INSTRUMENT. Small and compact yet Powerful! Has a tilting stand with mirror reflector and slide stage for USE IN THE LABORATORY. . Will magnify surface views up to 150 POWER when separated from stand to USE AS A POCKET MICROSCOPE. . Has an attachment to hold slide directly in the instrument for using as FIELD MICROSCOPE.

7.95

COMPLETE WITH SLIDES & LEATHER CASE.

EYE LOUPE SET

An indispensible aid to the Jeweler, Scientist, Watchmaker, Instrument Repairman, Lab Technician, Machinist, etc. Available in 2½ – 2¾ – 3¼ – 4 & 5 power magnification. Your choice of two loupes (any power) & 1 inspection mirror. . A Palley Combination Bargain– ONLY . . or Individual Loupes (any power) – 99¢ each.

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8 POWER COATED LENS TELESCOPE

10.00 VALUE **$4.95**

A very handy instrument for spotting distant objects. Small as a pocket pen yet has full 8 POWER magnification. Has expertly ground, precision polished lenses. Body is made of fine grade, polished metal with pocket clip. Easy focusing. 8¼" expansion. A $10.00 Value.

SWISS PATTERNED NEEDLE FILES

SET OF 12

The ideal set for the model maker, technician, repairman, etc. Made of the finest quality, Sheffield Steel, specially hardened and accurately machined for precision filing. Set of 12 ass't shapes – A $5.00 Value –

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LUND TRAILWAY SNOW SHOES

Genuine LUND Snow Shoes. Size of frame is 10" by 52". The one-piece, special hardwood frames are laced with good quality, water-proof, thongs. Designed for faster, easier travel.

22.50 VALUE . . . **14.95**

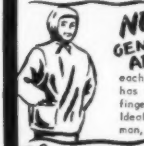
7 Ft. G.I. SKIS with metal edges. . $13.50

SKI POLES

Natural cane or laminated steel pole with leather laced snow ring. Pole is metal tipped. Has wrist straps. Length is 4 feet. Ideal for use with skiis or snow shoes. A Palley Value at

Only 3.95

NEW! GENUINE ARMY SKI PATROL PARKAS



Made of heavy White Duck. Wind and water resistant. Slip-over type with draw strings on each cuff and around waist and hood. Neck has four tie-straps for adjustment. Body is finger-tip length with 2 large outer pockets. Ideal weather protection for the outdoor sportsman, hunter, farmer, rancher, etc. A BUY!

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NEW GOGGLES

Soft, molded rubber frames, chamois lined. Comes with 8 lenses, 2 clear, 2 amber and 4 Green. All lenses are easily and quickly inter-changeable. COMPLETE

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FOAM RUBBER

in Slabs, Sheet stock & molded, preformed Cushions, Mattresses & Pads. Use it for upholstering, beds; pillows, nooks, chairs, sofas, patio & yard furniture, auto seats, boat deck pads, etc. Priced FAR BELOW current market.

CORED STOCK—Smooth one side, "cored" on other side to give maximum resilience & reduce weight. Ideal for chairs, cots, beds, bunks.

thick.	per sq. ft.	thick	per sq. ft.
1"	.80	3"	$1.70
1½"	1.10	4"	3.00
2"	1.50	4½"	3.14

SLAB STOCK – Smooth both sides. A solid but spongy material. Used for pads or shock-absorbing layer pads.

Thick	Per sq. ft.
1/4"	$.25
1/2"	.50
3/8"	.38
3/4"	.75
1"	1.00

PALLEY'S WILL CUT the Slab or Cored Sheet Stock to your needs. However all pieces must be rectangular or square in shape, at least 1 sq. ft. or larger.

TOPPER PADS

25"x60"x1½"	$7.95
25"x60"x1½"	8.95
25"x65"x2"	9.95

SEAT PADS

22"x 18"x 3"	$5.00
22"x 20"x 3½"	$5.00
35"x 18"x 4"	$10.75
20"x 20"x 5"	$6.00

17 Power Telescope

A fine quality, IMPORTED instrument. Gives a bright, clear image with a wide field of view. An ideal telescope for all-around use. ONLY 7.95

20 Inch TANK TELESCOPES
3 Power..$4.95--20 Power..$8.95

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MASTER only – For an extra control . . . 21.25

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Telephone type, highly sensitive with excellent, Clear tone. This was the Signal Corps favorite. An ideal instrument for the radio "ham" and professional recording studio, broadcasting, home recording, public address, etc. . Complete with cord & plug . . . 3.29
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300 AMPS CONTINUOUS
350–400 AMPS. INTERMITTANT
For light or heavy duty work. Will easily handle welding up to ½" plate. Made to operate continuously, giving years of trouble free service. Built around that famous B-29(R-1) generator incorporating many features no other generator has. Unit includes pulley re-actor output controls. Hi-lo switches & rheostats. All assembled on heavy steel frame and easily adapted to mounting on jeep or tractor for portability & power supply. Can be run on 7½ H.P. electric or 10 H.P. gas motor. Generator alone cost Gov't $400!
NOW ONLY 97.50

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Made for Chemical Warfare Division for testing, water, etc. A handy addition to the chemistry lab. or an exciting experiment for the amateur. Set includes test tubes, complete instructions. 15 different items. Packed in attractive lucite box with cover and dividers . . . 1.89

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Approved by U.S. Bureau of Mines for DUST & MIST. New, cushion face-piece fits comfortably & allows easy wearing of helmet & goggles. Extra large filtering area provides higher efficiency. Uses single filter for all types of dust. Easy vision, adjustable head strap. With 10 extra filters. 1.79
NEW–VALVE TYPE – 29¢ ea.

NAVY Sealed Beam LAMP

U.S. NAVY portable searchspot light. Has pistol grip and aiming sight. Makes an ideal search, spot or emergency light for auto, boat, etc.

12V. light – 4" lens . . .	3.29
24V. light – 4" lens . . .	3.79
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WATCHES

Here's a real shock absorbing watch. Has jewel movement, sweep second hand, luminous dial, chrome case. An ideal watch for children or adults. Fully guaranteed. 6.95

17 JEWEL CHRONOGRAPH – One of the finest made anywhere. Sweep second hand, stop and re-set button. Measures airspeed, groundspeed, races, etc. Ideal watch for the sportsman. 26.95

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A handy light for desk, workbench, chart table, engine room, etc. Can be used on 6-12-24 & 110 Volt by changing bulb. 3 ft. shaft has 4 joints to adjust position. 3.29

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Operates on direct drive with a flex shaft from camshaft or at 2 to 1 reduction from crankshaft. Range is 0 to 4500 R.P.M. Ideal for planes, boats, autos, etc. 4.75

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GENUINE G.I. EQUIPMENT. Has a 6 inch, polished Vanadium blade & Handle made of leather and fibre discs. Complete with tanned leather sheath. Only 1.98

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The Very POPULAR CENTER FOCUS Model with Coated, Achromatic Lenses. Combines higher resolving power with extreme image brightness and amazing clarity. An IDEAL GLASS FOR ALL AROUND USE DAY or NIGHT! Has Lightweight, Precision made, Aluminum housing. Field of view is approx., 375 feet at 1000 yds. Complete with Leather Carrying Case and Neck Straps. 47.95
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Big, Powerful Lenses give maximum image brightness & needle-sharp vision. Individual eye focus. Wide field of view. With Leather Case and Straps. 33.95
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STRONG – LIGHTWEIGHT – NYLON FISHING LINE. ROT-PROOF and WATERPROOF . . .

1500 ft.	10 lb.	$1.59
1000 ft.	25 lb.	$1.80
750 ft.	45 lb.	$3.29
750 ft.	50 lb.	$3.50
300 ft.	72 lb. Braided	$3.79

HAND LINE

Rot-proof, weather resistant, hard linen line. Originally used as hand line in fishing for tuna, marlin, etc. Also has many uses around farm, factory, etc. NEW in 300 ft. lngths. 1.69

SILK PARACHUTE, CAR COVER– 24 ft in diameter (approx. 50 sq. ft.) Enough to cover any car or small truck. Heavy, double stitched seams. 16.95

AN IDEAL GIFT

NEW DRY LENSATIC COMPASS

Officer's type. A precision compass of unusual accuracy. Has prismatic, hair-line guide for sighting at distant objects & at same time reading the degree. Luminous dial for night, jewel mounted needle. Canvas carrying case for belt. NEW. Only 3.95 5.95 VALUE

A.F. FLEECE LINED JACKET

GENUINE LEATHER
Will keep you warm and comfortable in the roughest weather. Has fleece lining throughout . . . sleeves & body. Two roomy, slash pockets & full zipper front closure. Really an ideal jacket for all Outdoorsmen . . Hunters, Farmers, Mechanics, Ranchers. RE-CONDITIONED IN WONDERFUL CONDITION. 14.95

FLYING HELMET

Fine grade leather – Chamois lined with chin cup and strap. Intermediate weight. NEW – ONLY 1.59

ALL NEW! Winter type with fleece or chamois lining. Has ear puffs and chin cup. Ideal for pilots, cycle-drivers and sportsmen ONLY 1.95

Aviators (AN-6530) GENUINE GOGGLES

Windproof & Dustproof

Rubber or chamois covered frame. Clear or green GROUND LENSES are inter-changeable. Adjustable nose bar. Ideal for flying, motorcycling, etc. 2.19

GO-1 GOGGLE KIT NEW! U.S. NAVY Has soft sponge rubber frame. 4 Poloroid lenses, 2 green; 1 red; 1 clear. Perfect for racing, cycling, etc. . . . . SPECIAL 89¢

FLYING SUIT or Blue Bunny SUIT

For hunting, winter sports, skiing or "bundling". As coveralls, for cold outdoor or farm work. 100% woven wool with extra flannel inner lining for double warmth and utility. Wiring so fine, flexible, it does not interfere with movement. Can be used with or without heating or can be plugged into car, tractor or truck battery . . . . . ONLY 4.95
Sizes: 36 thru 44

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The ideal jacket for the Rifleman or Hunter . . . Has 14 individual, outside pockets for shells, glasses & other accessories. 2 large (11" x 8") inner pockets, a leather holder for knife, gun or tool. Sturdy, yet lightweight with tie-straps at back for adjustable fit 3.49

Hunting & Field BOOTS

Assures complete foot and shoe protection in the coldest weather. Specially designed to keep the feet warm and comfortable & the shoes dry. Has 9 inch leather boot top, rubber shoe & sole with felt inner sole. Reconditioned – in excellent condition. 3.95
A PALLEY BUY NEW 4.95

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Adds real pleasure to surf & deep stream fishing. Made of rubberized canvas. Vulcanized seams. Has inner air pockets, to give buoyancy & balance in deep water. Finest quality, rubber gloves & ½ length rubber boots attached to sleeves and pants legs 6.95
SIZES: small; medium; large

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PALLEY SUPPLY CO. DEPT. PS-1 6321 SAN FERNANDO RD GLENDALE 1 CALIF.

Death Designed This Fire Truck

[Continued from page 84]

Auto accidents also have increased enormously since McGinley was a rookie. Today, he thinks, there are more cases than ever in which people are trapped inside smashed cars and must be cut out. Rescue No. 1 carries power saws and metal cutters for the job (the oxyacetylene tool might ignite the gasoline). A few years ago it took 45 minutes to make a rescue like this. Now, with proper tools and training, it can be done in 15 minutes.

The valuable experience of other East Orange officials contributed to the planning of Rescue No. 1. Mayor Charles H. Martens, now finishing 34 years at his job, was one. Dr. Francis Lucas, long-time fire commissioner and a scientist who could spot defective equipment as no one else in the department could, was another. The American-LaFrance-Foamite Corporation built the truck at a cost of $35,940. Equipment cost thousands more.

Saving Lives Costs Money

"It was an expensive item," McGinley admits, "but it was worth every nickel. If I were chief, I'd give up any company for economy reasons rather than the one on the rescue truck."

Acting Chief George Rebhan of East Orange agrees. Rebhan, who keeps the records, doesn't know how many lives the truck saved in 1951, but he does know that nearly all of its oxygen patients recovered. "You can't measure those things in money," he says.

Saving lives is the first duty of the rescue squad; then comes the saving of property. The squad is so trained that in a minute it can stack furniture in the center of a room and throw tarpaulins over the stack. Rescue No. 1 carries 12 tarpaulins. "Water damage is almost nil," McGinley reports.

Radio Speeds Rescue Calls

When McGinley became fire chief in East Orange, 24 years ago, alarms traveled over open wires. Storms knocked down the wires. He still moves uneasily in his armchair by the fire when he thinks of sections of the town being cut off. Eventually, he got an underground alarm system, which is weatherproof. Rescue No. 1, furthermore, has two-way radio for communicating with headquarters, other fire trucks, chiefs' cars and the police. The radio is FM—because FM is static-free. The department also plans a walkie-talkie for the big emergency truck soon.

But even with the best communications in the world, there are times when turning in the alarm depends on the slightest tricks of fate.

Not long ago the East Orange rescue squad was called out to see if a man was buried in ashes in a silo at a concrete-block works. He was. He had been working in the silo when a load of ashes was dumped into it. The rescue squad cut blocks out of the silo walls and, with hand shovels, dug into the ashes and tossed them out the holes they had made. They found the man, put a harness on him, and hauled him out over the top of the silo, which was some 35 feet high.

Payday Pays His Life

The man was uninjured. He had been able to breathe because ashes are porous, and they hadn't been heavy enough to hurt him. But he could not have continued to breathe much longer than the five or six hours he was buried. "This was a rescue-squad job absolutely," McGinley says. "They do things other firemen can't, because of their equipment." But there was that trick of fate.

The day was payday, and the man buried in the ashes was not missed until he failed to show up for his money. That started the search and led to the rescue. "But," McGinley reflects, "if it hadn't been payday. . ." END

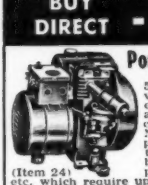
Bubble-Blowing Liquid Spots Puncture

When a tube bath isn't available, you can spot punctures by brushing on some of the bubble-blowing liquid that children play with. The smallest pinhole will produce a bubble. The liquid is good for testing a new patch, too.—*R. Janovsky, St. Louis.*

Does Rubber Burn Off Tires?

A careful study of the surface of the roadway in New York's Holland Tunnel, and even of the ducts in the ventilation system, fails to disclose any evidence of tire rubber. Scientists suspect, therefore, that rubber "worn" off automobile tires is burned off, not rubbed off.

BUY DIRECT - MASTER MECHANIC - UP TO 85% DISC.



Portable LIGHT PLANT

PUSH BUTTON START

500-700 watts 110-120 v., 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. **Be prepared if war or storm knocks out power lines.** Reg. $275.00 value..... **$143.50**

(Item 24)

1000-1200 Watt Plant (Item 45) same as Item 24, but larger generator & engine..... **$199.50**

GIANT 2000-2500 WATT PLANT

(Item 31)

110-120 V. 60 cyc., A.C. **Absolutely the best made** — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine —complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Special at..... **$299.50**

With Electric Self Starter (Item 179) **$359.50**

GENERATOR ONLY and control box. **$169.50**

Drive it with your engine or tractor

HI-LINE 6000 WATT PLANT

Push Button Start, 115-230 v. 60 cycle A. C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. (with self starter) Factory special..... **$645.00**

Same plant (with crank starter) (Item 166) Wt. 570 lbs... **$585.00**

Generator and control box only, belt driven. Use your engine or tractor. Wt. 240 lbs..... **$345.00**

We Are World's Largest Mail Order Distributors of Light Plants

VARIABLE SPEED SELECTOR

(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, holists—any operation requiring variable speed. Ideal for midget autos. Employs reliable "trouble free" planetary system. No hydraulic power losses or creeping. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. wt. 36 lbs; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs. Reg. list $228, $252 and $352. Brand new, in Goodrich boxes and guaranteed. Complete installation data included. Unprecedented surplus sacrifice **$79.50, $89.50** and **$114.50.**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, it removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.). 8" Fan, wt. 6 lbs. **$6.35;** 9" Fan, wt. 6 lbs. **$7.45;** 10" Fan, wt. 7 lb. **$8.45;** 12" Fan, wt. 8 lbs. **$9.45.**

HIGH PRESSURE HAND PUMP

(Item 53) Positive displacement type. Cap. 550 gph. Completely self priming. ¾" pipe thread inlet and outlet. Use for fuel or water transfer on boats, trailers, air craft, etc. Ideal for insecticides, emerg. sump pump or as vacuum pump. Wt. 15 lbs. Govt. cost $95. Our Special..... **$12.95**

GAUGE TESTER

(Item 27) Precision made of solid bronze and steel by Ashcroft. (Cat. #1300-5). Calibrated weights (incl.) acting against hydraulic piston provides quick accurate testing of all pressure gauges up to 500 psi. Brand new. Wt. 90 lbs. Reg. $318.00. Our Spec..... **$95.00**

IMMEDIATE DELIVERY—ALL ITEMS

HEAVY DUTY ARC WELDER

(Item 38) Use as portable or shop welder. 250 amps. D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs. A $400 value at..... **$99.75**

MAGIC TERMINAL model same as above but with built-in 3rd terminal for low heat soldering and brazing. Special..... **$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.. **$10.50**

A-C ARC WELDER

(Item 168) Master Hi-Line A-C Arc Welder. **20-190** amp. output. Welds or cuts iron, steel, brass, etc. from 24 gauge to 5/8" with single pass. Operates from 220/230 V. 50/60 Cycle A-C line. None better. Meets REA requirements. Handles 1/16" to ¼" rods. Adjustable output for any job. In sturdy steel cabinet, on casters. Full instru. and 1 yr. guar. incl. Wt. 210 lbs. Reg. $250 value..... **$159.50**

(Item 169) 20-190 amp. A-C Welder operates on 110 or 220 V. Wt. 65 lbs. Worth $125..... **$64.95**

(Item 181) Welding Kit incl. helmet, 2 leads, electrode holder, ground clamp, power cord and rods (sold only with welder) Wt. 12 lbs..... **$12.50**

CARRY-AIR

(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 10 lbs. Worth $20.00. Our price..... **$8.95**

(Item 55) With big double tank (1000 cu. in.)..... **$11.95**

POTTERS WHEEL

(Item 47) Complete, prof. equip. for making finest ceramics and pottery. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 16x12" enclosed throwing table—ample area for largest pieces. Req. ¼ hp. motor not incl.. Can be set up on 20x24" table and stored on edge. Complete with pulleys, belts and instructions. Wt. 26 lbs. $145 value at..... **$59.95**

ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. **Operates at any angle in a full 360° arc.** Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck ¼" capacity and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95—while they last..... **$9.95**

RUBBER HOSE

TERRIFIC VALUES!

New genuine Neoprene Hose — outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections. Included. **Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil.** Save more than 60%.

(Inside Diam.)	1"	1¼"	1½"
Length	10 ft.	25 ft.	30 ft.
Price	5.95	9.25	14.75

If specified we will send special hose for gas or oil at same prices.

Send 10c for a Big War Surplus Catalog. Included Free with Every Order.

MAKES SNOW REMOVAL REAL FUN!

SNOW-BLO

(Item 72)

The sensational device that makes snow removal real fun. Easy — a child can operate it. Safely guarded whirling impeller quickly scoops up the snow and blows it 25' either side. Big timesaver. Clears driveways and walks in a jiffy. Eliminates dangerous exhaustion and overtaxed heart, which kills so many every winter. BOYS! Make big money clearing snow for neighbors. Easily converted to lawn mower when desired. New silent electric model powered by ½ hp. motor clears 16" swath. Complete with **Stockproof** 100' cord (Item 72)..... **$139.50**

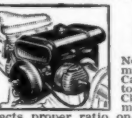
Gasoline Model with easy starting 2 hp. 4 cycle engine (Item 73).. **$159.50**

For large areas (2½ hp. engine) (Item 74)..... **$179.50**

We pay freight on Snow-Blos.

FREE with purchase of any model, an extra 100' extension cord.

COMMANDO BIKE MOTOR



(Item 90)

New, super-modern 1952 model. This job is the Cadillac of all bike motors. Sensational Auto-Clutch prevents killing motor at each stop. Also selects proper ratio on hills. Mounts behind and drives rear wheel with Dynarotor. Free Wheeling lever permits pedalling if desired. Rear Mounting eliminates fumes, heat, dirt, and hard steering. Easily installed in 15 minutes with home tools. Sturdy, trouble-free, easy starting, light weight. Airplane type engine; up to 150 miles per gallon. Fully guar. Ride for fun or profit. Ideal for deliveries, paper routes, messenger service, etc. Ride to work and save.

The Commando Captain, 1 cylinder 1½ hp. **$99.75**

The Commando General, 2 cylinder 3 hp. (Item 91)..... **$125.00**

All Commandos shipped prepaid in U.S.

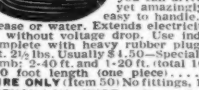
FIRE EXTINGUISHER

(Item 39) Fully charged (at 1,000 lbs. F. S. I. or more) with CO_2 (carbon dioxide) the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe: keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. RETRIALBLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. $19.50 value. Special..... **$6.95**

LARGE FIRE EXTINGUISHER

(Item 57) commercial size, 5 x 14 in. (275 cu. in.) heavy ICC approved steel cylinder charged at 1000 lbs. or more with CO_2. Equipped with genuine Kidde Valve. Refillable. Hose incl. Suitable for fire depts., stores, garages, homes, etc. Wt. 18 lbs. $42.50 value. Spec.. **$15.85**

EXTENSION CORD



(Item 16) 40 ft. heavy duty, made of specially insulated No. 16 2-conductor wire. So tough that you can drive over it and yet remain pliable, flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $1.50—Special 40 ft. **$1.98**

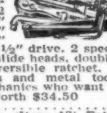
Comb: 2-40 ft. and 1-20 ft. total 100 ft.: **$4.95**

100 foot length (one piece)..... **$4.85**

WIRE ONLY (Item 50) No fittings, 100 ft. **$4.00**

TRENCH-LAY WIRE. (Item 51) **Anaconda** #10—2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, **19c** per ft.; 250 ft., **18c** per ft.; 500 ft. **7c** per ft.

34 pc. SOCKET SET



(Item 59) Highest quality guar. non-breakable sockets made by Plomb, Snap On, etc. Complete range of 23 sockets from ¼" thru ¾" in ⅛" drive and 7/16" thru 1-1/16" in ½" drive. 2 speeder handles, 2 extensions, 2 slide heads, double ⅜ x½ in. or "L" handle, reversible ratchet, Adaptor bit, 2 end wrenches and metal tool box. For professional mechanics who want the best. Wt. 14 lbs. Easily worth $34.50 while they last..... **$16.95**

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(Item 43) Extra heavy for dual truck tires, 7.50x20, triple side links, made by Intl. Chain. Reg. list $57.50— our special..... **$19.50**

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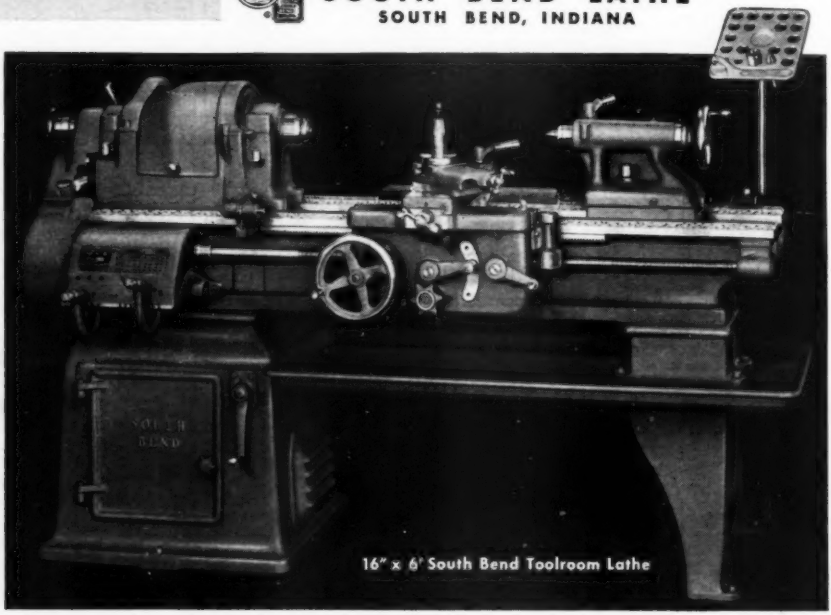


16" x 6' South Bend Toolroom Lathe

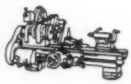
SPECIFICATIONS OF SOUTH BEND 16" LATHES

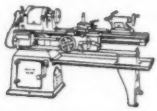
Swing: 16¼" over bed, 9⅝" over cross slide.
Bed Lengths . . . . . 6 to 12 feet
Center Distance . . . . . 33½" to 105½"
Cross Slide Travel . . . . . 10½"
Spindle Speeds:
8-Speed Drive . . . . . 25 to 770 r.p.m.
12-Speed Drive . . . . . 20 to 945 r.p.m.

Collet Capacity . . . . . 1"
Spindle Bore . . . . . 1⅜"
Power Feeds:
Longitudinal: 48 R.H. or L.H., .0015" to .0841"
Cross Feeds: 48 . . . . . .0006" to .0312"
Thread Cutting: 48 R.H. or L.H. pitches . . . . . 4 to 224 per inch

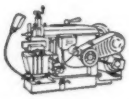
Send Information Checked:

☐ 16" TOOLROOM LATHES
☐ 16" QUICK CHANGE GEAR LATHES
☐ LATHE ATTACHMENTS


☐ 9" and 10" BENCH LATHES


☐ 10" TO 16-24" FLOOR LATHES

☐ 14" DRILL PRESSES


☐ 7" BENCH SHAPERS

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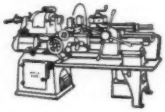
☐ TURRET LATHES ½" and 1" Collet



A new year . . . for opportuni

1952 OPPORTUNITY OUTLOOK

RADIO-TV

Wide-open, fast-moving field. Look for big gains in TV—new stations, UHF channels, improved color. Excellent opportunities for qualified servicemen, electronics experts, operating technicians. Up-to-date training essential.

AVIATION

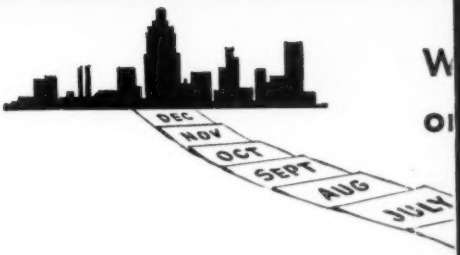
Defense orders expected to double airframe and engine production. There's already an urgent need for aircraft draftsmen and aeronautics engineers, tool designers, mold-loftsmen, machine shop workers, mechanics. Good openings for trained newcomers.

AUTOMOTIVE

Cutbacks in new-car production will keep old cars on the road. Means big business for auto mechanics, body rebuilders and refinishers. Increasing demands for new men. Experience not so important as proper training.

ENGINEERING

New engineers can expect many attractive offers, can take their pick of jobs. Starting salaries of $100 a week. Industry desperately needs chemical, electrical and mechanical engineers. Will readily accept men trained by reputable schools.



W

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YOU'RE too smart to stay in the same old rut! You know that you have one life—that's all. So you've thought about *doing* something that would advance you in your work, increase your income.

The time to get started is *now*. And you can take the first step toward Personal Success this very minute!

Just look over the prestamped, preaddressed card below and mark the I. C. S. course in your field of interest. Then mail it—*today!*

We'll send you complete information on the International Correspondence Schools, and how they can give you the training you need to get ahead faster. Cost is low, texts are easy to understand, and every student gets *personal* service.

The time to "take steps" is RIGHT NOW!

DRAFTING

Opportunities are exceptionally good. Will get even better during the year. Qualified men due for rapid advancement. Quick training available for beginners. Aircraft, ship, electrical drafting head list of essential classifications.

BUSINESS

Outlook is especially bright for accountants, federal tax experts, traffic managers, typists, stenographers. Employers will put greater emphasis on specialized training in effort to trim costs and step up efficiency. Self-improvement will be welcomed and rewarded.

ACT NOW! Mark and mail this prepaid postcard for complete information on what I. C. S. can do for *you* in '52.

FREE HIGH SCHOOL BONUS

By taking a regular I. C. S. course, you can earn *bonus credits* toward a high school diploma.

You choose whatever course you want (there are more than 400 to choose from). Then, as you study, you automatically earn up to one-half the credits required for an I. C. S. high school diploma. No extra work. No extra cost.

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e year from TODAY?

• Please send me complete particulars about the course BEFORE which I have marked X:

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- ☐ Heating ☐ Plumbing
- ☐ Refrigeration ☐ Steam Fitting
- ☐ Chemistry, Analytical
- ☐ Chemistry, Engineering
- ☐ Chemistry, Industrial
- ☐ Petroleum Refining Operator's
- ☐ Plastics ☐ Pulp and Paper Making

Civil Engineering, Architectural and Mining
- ☐ Architecture
- ☐ Architectural Drafting
- ☐ Bridge and Building Foreman
- ☐ Building Estimating
- ☐ Civil Engineering ☐ Coal Mining
- ☐ Concrete Engineering
- ☐ Contractor's, Building
- ☐ Highway Engineering
- ☐ House Planning
- ☐ Structural Drafting
- ☐ Structural Engineering
- ☐ Surveying and Mapping

Communications
- ☐ Electronics
- ☐ Radio, General—Operating
- ☐ Radio Servicing, Practical
- ☐ Practical Telephony
- ☐ Telegraph Engineering

Electrical
- ☐ Electrical Engineering
- ☐ Electric Light and Power
- ☐ Industrial Electrical Engineering
- ☐ Lighting Technician
- ☐ Power House

Internal Combustion Engines
- ☐ Automobile Technician
- ☐ Aviation ☐ Diesel-Electric
- ☐ Diesel Engines ☐ Flight Engineer
- ☐ Gas Engines

Mechanical
- ☐ Aircraft Drafting ☐ Foundry Work
- ☐ Heat Treatment of Metals
- ☐ Industrial Engineering
- ☐ Locomotive Machinist
- ☐ Mechanical Drafting
- ☐ Mechanical Engineering
- ☐ Machine Shop
- ☐ Patternmaking, Wood-Metal
- ☐ Reading Shop Blueprints
- ☐ Sheet-Metal Worker
- ☐ Ship Drafting ☐ Shipfitting
- ☐ Tool Designing ☐ Tool Making
- ☐ Welding Engineering

Railroad
- ☐ Air Brake ☐ Car Inspector
- ☐ Diesel Locomotive
- ☐ Locomotive Engineer
- ☐ Locomotive Fireman
- ☐ Railroad Car Repairer
- ☐ Section Foreman

Steam Engineering
- ☐ Boilermaking
- ☐ Combustion Engineering
- ☐ Engine Running
- ☐ Marine Steam Engineering
- ☐ Steam Electric ☐ Steam Engineering

Textile
- ☐ Cotton Manufacturing
- ☐ Loom Fixing ☐ Rayon Weaving
- ☐ Textile Designing
- ☐ Woolen Manufacturing

Business and Academic
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- ☐ Bookkeeping
- ☐ Business Correspondence
- ☐ Business Management
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Representatives in cities and towns throughout the world

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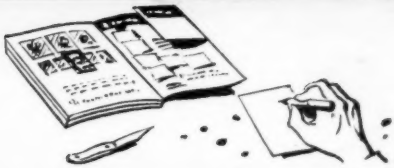

Time to turn over a new leaf!

What better way to start than to turn over *this* leaf and mark the field of opportunity that interests you?

With the free information I. C. S. will send you, you can intelligently plan a *real* program of self-improvement. You'll be able to map out a step-by-step method for getting exactly what you want—promotion, bigger pay, a better job.

What you do *now*—in the next few minutes—can make a tremendous difference to you in the year to come. The card below is stamped, addressed and ready to go! Cut it out! Mail it!

There's nothing to lose and everything to gain!

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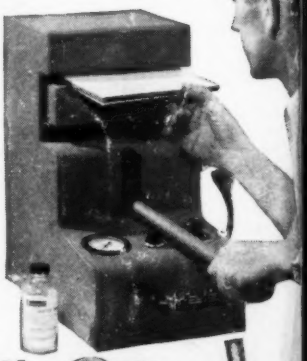

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